CSS BoSC 2016 Poster Guide

Wednesday, November 16th – Posters No. 1 – 23 (HTT, RED, AOPDD, VTM, D&E) author attended

Thursday, November 17th – Posters No. 24 – 38 (LCHEM, SUSTCHEM, EM, ECOMOD, CSS STAR) author attended

Chemical Evaluation

High Throughput Toxicology:

1. HTT: Predictive models target organ and systemic toxicities

The objective of this work is to predict the hazard classifications and point of departure (PoD) of untested chemicals in repeat-dose animal testing studies. We used supervised machine learning to objectively evaluate the predictive accuracy of different classification and regression algorithms using chemical structure information, physico-chemical properties, and in vitro bioactivity data. The mean F1 score for predicting 20 target-organ hazard classes across three guideline study types was 0.69, and the R2 for predicting the PoD for systemic toxicity was 0.38. These models can be used to efficiently prioritize tens of thousands of environmental chemicals by hazard and by PoD.

2. HTT: Metabolism Retrofit Strategies for ToxCast Assays

Chemical hazards may be mischaracterized due to the lack of xenobiotic metabolism (XM) in current ToxCast assays. This project pursues two parallel approaches to address biotransformation in vitro. The first approach generates metabolites in the assay matrix (buffer or cell media) using alginate-encapsulated human liver homogenate. The second approach generates metabolites within cells using a modified mRNA transfection method that facilitates XM gene expression mirroring that of specific human tissues (i.e. liver).

3. HTT: Evaluation of Sequencing Approaches for High-Throughput Toxicogenomics

Whole-genome in vitro transcriptomics has shown the capability to identify mechanisms of action and estimates of potency for chemical-mediated effects in a toxicological framework, but with limited throughput and high cost. We present the evaluation of three toxicogenomics platforms for potential application to high-throughput screening: 1. TempO-Seq utilizing custom designed paired probes per gene; 2. Targeted sequencing (TSQ) utilizing Illumina's TruSeq RNA Access Library Prep Kit containing tiled exon-specific probe sets; 3. Low coverage whole transcriptome sequencing (LSQ) using Illumina's TruSeq Stranded mRNA Kit. In summary, the three toxicogenomics platforms showed the ability to measure whole-genome transcript levels with good technical reproducibility and show promise for the integration of toxicogenomics into high-throughput screening.

4. HTT: Expanding the capability to screen and prioritize chemicals for developmental neurotoxicity

A battery of medium- to high-throughput assays has been developed to test for chemical effects on key events of neurodevelopment at the level of the cell, tissue, and intact organism. Technical performance of the assays has been demonstrated using positive control chemicals for each assay. The ability of the assay battery to prioritize and rank potential developmental neurotoxicants is being evaluated using a set of reference chemicals with known in vivo activity.

Rapid Exposure & Dosimetry

5. RED: Identifying Priority Chemicals in our Environment Using Non-Targeted/Suspect Screening

Thousands of chemicals are present in the food we eat, water we drink, air we breathe, and materials we touch. New high-resolution mass-spectrometry based methods are being utilized to identify large numbers of chemicals in environmental media, biological matrices, and consumer products in a high-throughput manner. When combined with new databases of chemoinformatic information, these twenty-first century tools will help characterize the universe of human chemical exposures.

6. RED: New Tools for Predicting the Magnitude and Pathway of Chemical Exposure

Quantitative population human exposure estimates are required to interpret the toxicological information generated with high-throughput screening (HTS) in a risk context. New mechanistic and statistical models are being generated to predict how and why thousands of chemicals are used (e.g. in products, in industry, in our homes), the pathways by which humans come into contact with these chemicals, and the magnitude of exposures that result. The predictions from these models and others are being evaluated against human monitoring data within a statistical framework to generate calibrated consensus human exposure predictions for use in risk-based prioritization of chemicals for further study.

7. RED: Evaluating and Refining High Throughput Tools for Toxicokinetics

Prioritization relies upon risk analysis based upon assessments of toxicity, exposure potential, and toxicokinetics. In vitro tools adapted from the pharmaceutical industry have now allowed rapid prediction of possible toxicokinetic outcomes for hundreds of chemicals. The models used have been made publically available in a public statistical software package that is being continuously updated with new chemicals and models, including the ability to simulate human gestational exposures and human population variability. These models are being continuously evaluated through curation on of in vivo data from the scientific literature and the generation of new in vivo studies for priority chemicals.

8. RED: High Throughput Estimates of Ecological Exposure

High-throughput methods for prioritizing chemicals for further study must consider potential risks to ecological systems and wildlife populations. New minimally-parameterized models are being developed for predicting surface water concentrations (and aquatic biota exposures) resulting from industrial and residential use of chemicals. These models and other existing models for ecological exposure will be evaluated against new temporally and spatially resolved water concentration data to develop consensus forecasts of ecological exposures for integration with HTS data in chemical prioritization schema.

Complex Systems Science

Adverse Outcome Pathways Discovery & Development

9. AOPDD: Integration of chemical-specific exposure and pharmacokinetic information with the chemical-agnostic AOP framework to support high throughput risk assessment

Application of high throughput toxicity testing and the Adverse Outcome Pathway (AOP) framework in chemical-specific risk assessment requires reconciling chemical concentrations sufficient to produce activity in vitro with those that trigger a molecular initiating event at the relevant target site in vivo. We developed a tiered approach — involving qualitative refinement, quantitative ranking, and quantitative modeling — to connect biological process-based AOPs to biochemical process-based pharmacokinetic behaviors (absorption, distribution, metabolism, and excretion) through consideration of chemical properties that influence both external exposures and internal pharmacokinetic characteristics. Additionally, we conceptualized an Aggregate Exposure Pathway (AEP) framework to organize exposure data and provide the missing chemical-specific exposure and ADME link to the AOP framework.

10. AOPDD: Case Studies Using the AOP Framework and Pathway-Based Data to Evaluate and Develop In Vivo, In Vitro, and Non-Lethal Approaches for Assessing Adverse Effects on Biota Residing in Contaminant Impacted Surface Waters

High throughput in vivo, in vitro, and non-lethal approaches that provide a rapid and sensitive assessment of exposure to environmental contamination are needed to improve risk assessments. However, clear connections between these early indicators and the adverse outcomes upon which regulations are based (e.g., reproduction, survival, etc.) are required to solidify their utility. Here we present selected case studies designed to develop and refine these linkages through the use of adverse outcome pathways at sites of high importance to our Regional and Program Office partners.

11. AOPDD: Use of Putative Adverse Outcome Pathways for Chemical Hazard Identification

The Adverse Outcome Pathway (AOP) framework provides a knowledge infrastructure for evaluating health effects of environmental chemicals. In this work we are examining proof-of-concept issues in the development and prospective application of AOPs in chemical safety. Key outputs include tools for more rapid assembly of AOPs, predictive models for screening large chemical sets, and susceptibility biomarkers based on early events in AOPs.

12. AOPDD: Integrating Thyroid Research across CSS

An integrated research program was developed to address the needs of the Agency to identify and assess the impact of chemicals with the potential to disrupt the thyroid axis. Organized around the Adverse Outcome Pathway framework, this research incorporates in vitro chemical screening assays, cell and tissue level system model assays, and in vivo assays across model organisms to verify MIEs and essentiality of key events in the AOPs. The ultimate goal of this research is to develop computational systems models that integrate information on potential thyroid hormone disruption for accurate predictive toxicology across species.

Virtual Tissues Models:

13. VTM: Virtual Embryo: Cell-Agent Based Modeling of Developmental Processes and Toxicities

Morphogenetic events are determined by genetic signals but driven by cell-generated physical forces and cellular dynamics. Fundamental cell behaviors - mitosis, migration, differentiation, adhesion, shape-change, apoptosis, and ECM remodeling – are integrated into a realized series of morphogenetic events by collective cellular behaviors. The coordination of cellular dynamics is fundamental to developmental processes and toxicities. Here, we describe the heuristic use of cellular agent-based models to recapitulate critical morphogenetic transitions for computer simulation of ToxCast data into a quantitative prediction of developmental toxicity.

14. VTM: Case Study: Organotypic Human in Vitro Models of Embryonic Morphogenetic Fusion

Embryonic fusion events during development are tightly controlled by gene regulatory networks and are thus sensitive to perturbation by chemicals, resulting in birth defects. This project develops an in vitro model of embryonic fusion that recapitulates the phenotype and architecture of embryonic palatal tissue for developmental toxicity assessment. Ongoing work is aimed at assessing the fusion of engineered palatal tissues upon treatment with pathway inhibitors and both known and putative cleft palate teratogens.

15. VTM: Case Study: In vitro Models of Human Embryonic Mesenchymal Transitions in Morphogenesis

Embryonic morphogenesis depends upon epithelial and endothelial to mesenchymal transition (EMT) to form proliferative, migratory mesenchymal cells. EMT produces progenitor mesenchymal cells that form parenchymal cells for organ anlagen and other cell populations and if perturbed by genetic and chemical stressors results in abnormal development. This task focuses on the developing heart as a case study of endothelial mesenchymal transition (EndMT) because of the critical role of EndMT in heart septation and the high incidence of heart septal malformations in the human population.

16. VTM: Toxicological Tipping Points: Learning Boolean Networks from High-Content Imaging Data

The objective of this work is to elucidate biological networks underlying cellular tipping points using time-course data. We discretized the high-content imaging (HCI) data and inferred Boolean networks (BNs) that could accurately predict dynamic cellular trajectories. We found three main classes of BNs including: cell recovery, adaptation, and injury. We believe biological network analysis can predict critical chemical exposures and mechanism underlying cellular tipping points.

17. VTM: Agent-Based Computational Modeling to Examine How Individual Cell Morphology Affects Dosimetry

Dosimetry in vitro at the level of individual cells (microdosimetry) is a determinant of how those cells respond to toxic stress and, when evaluated for all or a representative subset of the cells in the culture, of how the culture responds. As an initial step towards characterization of microdosimetry in support of in vitro to in vivo extrapolation, we have developed a stochastic, agent based computational model of cells growing in culture from initial seeding to full confluency. In an evaluation of in vitro data obtained with the oxidant hydrogen peroxide (H2O2), the agent based model, in agreement with the data, predicted a trend towards decreasing cellular dose of H2O2 with increasing confluency and correspondingly, a decrease in peak oxidation of a fluorescent reporter with increasing confluency.

CSS Translation & Delivery

Demonstration & Evaluation for Risk-Based Decisions

18. D&E: Generalised Read-across (GenRA) prediction using chemical and biological information

Read-across is a popular data gap filling technique within category and analogue approaches for regulatory purposes. Acceptance of read-across remains a challenge with several efforts underway for identifying and addressing uncertainties. However these to date have been qualitative in nature. Here an algorithmic approach to facilitate read-across using ToxCast in vitro bioactivity data in conjunction with chemical descriptor information to predict in vivo outcomes in guideline (and guideline-like) testing studies from ToxRefDB is demonstrated. The read-across

prediction for a given chemical is based on the similarity weighted endpoint outcomes of its nearest neighbors, calculated using in vitro bioactivity and chemical structure descriptors, called Generalized Read-across (GenRA). GenRA is a first step in systemizing read-across by providing performance metrics and enabling the scientific confidence of a prediction to be objectively assessed.

19. D&E: Systematic Evaluation of Analogs and Automated Read-across Prediction of Estrogenicity for Hindered Phenols

Read-across is a data gap filling technique widely used within category and analog approaches to predict a biological property for a data-poor (target) chemical using known information from similar (source analog) chemical(s). Although much guidance has been published for read-across, practical principles for the identification and evaluation of the scientific validity of source analogs remains lacking. This case study explores (1) the ability of structure descriptor methods for identification of analogs for read-across ER binding predictions, and (2) the utility of data quality measures, physchem properties, and R-group properties for filtering relevant analogs to ascertain better predictions and improvement in uncertainty associated with read-across ER binding predictions for hindered phenols.

20. D&E: Assessing Uncertainty in Risk Assessment Models

Computational models built on the U.S. EPA's ToxCast data are being used to rank and prioritize the toxicological risk of tested chemicals and to predict the toxicity of tens of thousands of chemicals not yet tested in vivo. As these models are increasingly used in risk assessments, methods to quantify the uncertainty in model predictions are increasingly important. We used bootstrap resampling methods to quantify uncertainty in model fits of concentration response data and propagated these uncertainties through mathematical models built to predict bioactivity from ToxCast data, which allowed us to better identify false positives and negatives in model predictions, improve separation of biological activity from assay noise, enhance the quality of model output, and thus increase confidence in model predictions for use in risk assessments.

21. D&E: RapidTox Dashboard – A tool for Rapid Risk Assessments

RapidTox is a new project that is bringing together public data and models on tens of thousands of chemicals to enable rapid, first-order risk assessments, primarily for data poor chemicals. The dashboard provides an easy-to-use user interface into the databases and models. Currently available data domains are physchem, in vitro (ToxCast and others), in vivo, chemical use and exposure, and the open literature.

Partner-Driven Research

22. CSS: A Proposed Approach for the Application of CompTox Data to Support the Identification of Candidate Common Mechanism Groups for the Cumulative Risk Assessment of Pesticides

Cumulative risk assessment (CRA) is used to analyze and characterize the combined risks to health or the environment posed by exposure to multiple chemicals. High-throughput screening data from the US EPA's ToxCast research effort can provide mechanistic insight on chemicals that might inform chemical groupings for CRAs. A proposed workflow outlines how integration of ToxCast bioactivity data with chemical structure, apical outcome and mode of action information can be used to evaluate common mechanisms of chemicals. Preliminary case study results from a subset of chemicals supports the use of ToxCast data as an additional line of evidence to inform chemical group characterization in the CRA process.

Stakeholder Engagement

23. CSS: Measuring the Impact of EPA's Computational Toxicology Research

EPA's computational toxicology research has made transformative scientific advances in how thousands of chemicals can be evaluated for potential health effects. This project is tracking metrics for research outputs such as EPA CompTox publications, data and web applications to establish trends that showcase the wide-spread impact of the research. Using metric trends, a beta-version of a website has been developed to communicate the impact of CompTox research to the expanding groups of stakeholders interested in using CompTox to better evaluate chemicals. CSS is learning from this project and plans to broadly apply findings to the CSS research program.

Life Cycle Analytics

Sustainable Chemistry

24. SustChem: Cheminformatics and data mining approaches for exploring the alternatives testing landscape: Case studies in ToxCast and Skin sensitization

Cheminformatics approaches have been used to demonstrate that the ToxCast chemical library provides comprehensive coverage of the knowledge domains and target inventories of interest to the Agency. Building on this work, the first case study illustrates how ToxPrints - an objective, transparent, and reproducible means of representing chemicals in local neighborhoods - can be used to probe chemical bioactivity enrichment patterns across the in vitro assay landscape. A second case study critically evaluates common assumptions associated with the induction of skin sensitization (SS), showing that chemical reactivity, plays a rate determining role in SS induction rather than skin penetration.

25. SustChem: The EPA Chemistry Dashboard

The chemistry dashboard is a public-facing web-based application delivering access to various types of data of interest to environmental scientists. The website integrates data for ~720,000 chemicals including experimental and predicted physicochemical properties, product and functional use data, ToxCast bioassay data, and a link farm to other agency resources and public websites. Search functionality presently delivers text-based searching by CAS Registry Number, systematic and trivial names as well as mass and molecular formula based searching to support mass spectrometry based non-targeted analysis.

26. SustChem: Chemical Transformation Simulator: A Cheminformatics Tool for Prediction of Transformation Products and Physicochemical Properties

The Chemical Transformation Simulator (CTS) is a web-based high-throughput screening tool that integrates cheminformatics, computational chemistry and software technologies to automate the calculation and collection of physicochemical properties for the parent chemical and predicted products resulting from transformation in environmental systems and metabolism in biological systems. Transformation products are predicted through the implementation of reaction schemes that encode how and under what circumstances a particular structural fragment will be modified by the transformation reaction. Libraries of reaction schemes are available for metabolism and aerobic biodegradation, and we are developing reaction libraries for a number of environmental transformation processes including hydrolysis, abiotic reduction, and photolysis.

27 SustChem. Facilitating Alternative Assessment: Frameworks for Data Generation and Sustainable Synthesis

The goal of frameworks for alternatives assessment (AA) is to facilitate a comparison of alternatives to a chemical of concern, resulting in the identification of safer alternatives. To support and increase the application of an AA framework, a multi-stage methodology for comparing chemical alternatives was developed. In the first stage, alternatives are compared using a variety of human health effects, ecotoxicity, and physical properties. Hazard profiles are completed using a variety of online sources and quantitative structure activity relationship models. In the second stage, alternatives are further evaluated utilizing an exposure/risk assessment over the entire life cycle. In the next stage, a preliminary framework has been developed for identifying a more sustainable synthesis of the identified alternative. This framework is designed to apply existing knowledge of green chemistry, along with its integration into Life Cycle Assessment culminating in the development of a more overall sustainable chemical entity when compared to its predecessor.

Emerging Materials

28. EM: Supporting the evaluation of engineered nanomaterials with a decision framework and informatics database (“NaKnowBase”)

Transformative approaches are necessary to evaluate the potential environmental impacts of nanotechnology including developing the capability to forecast potential for engineered

nanomaterials (ENM) to be released into the environment, to be transformed and transported, to lead to exposures, and to cause adverse effects. We propose a "Decision Support Framework" that provides a conceptual flow diagram of ENM in the environment with a database and informatics approach ("NaKnowBase"), which systematically captures and enables the meta-analyses of data, including that from key functional assays of ENM. The overall goal of this work is to enable, through the combination of the framework, database, modeling and informatics, more efficient evaluation of novel ENM and improved predictions of potential problems associated with their future use.

29. EM: Development of Functional Assays Linking Nanomaterial Life Cycle Exposure Events with Adverse Outcome Pathways

The Emerging Materials Project is focused on developing alternative testing models and technical capability to predict adverse impacts on human and ecosystem health from the use and application of engineered nanomaterials (ENM) or nano-enabled products (NEP). Due to the significant number and permutations of ENMs, a novel approach for the evaluation of ENMs and NEPs is required. Functional Assays focus on quantifying measurable and translatable parameters/properties associated with a specific effect in often complex systems. The specific effect of interest may be associated with a quantifiable response of the system, system component, or of a ENM or NEP process or property. Using the Decision Framework, Functional Assays are being developed based on critical exposure points identified along the ENM and NEP life cycle. These assays provide an approach to integrate multiple data streams that will link exposure to effects in order to discover and develop Adverse Outcome Pathways used to predict risk and hazard associated with ENM and NEP hazards.

30. EM: Modeling ENM Transport and Transformation to Evaluate Aquatic Environmental Exposures that Initiate Biological Responses

Environmental fate models developed for traditional contaminants are limited in their ability to simulate nanomaterial behavior in the environment by incomplete understanding of the processes that govern nanomaterial dispersion in the environment and by the paucity of data quantifying the interaction of nanomaterials with aquatic particles and natural organic matter. In this research effort, the well-known Water Quality Analysis Simulation Program (WASP) is updated with particle attachment and phototransformation kinetics to simulate ENM transport and transformation in surface waters. Ongoing work includes research to provide relationships and data for estimating interactions of nanomaterials with environmental surfaces, nanomaterial transformation rates, and biomarker responses for incorporation into the WASP8 modeling system.

Life Cycle & Human Exposure Modeling

31. LCHEM: Constructing the Human Exposure Model to support rapid estimates of exposure to chemicals in consumer products

Chemicals enter into commerce by a decision to incorporate a chemical into a commercial product, or into a process that creates a product. This project is building tools to assess rapidly chemical exposures that occur over the lifecycle of a product and thus will support the

development of safer and more sustainable products. The HEM will support various types of assessments from the assessment of a specific chemical in a specific product to the determination of combined exposures to multiple chemicals from use of a wide range of products.

32. LCHEM: A Novel Framework for Characterizing Exposure-Related Behaviors Using Agent-Based Models Embedded with Needs-Based Artificial Intelligence

Information on where and how individuals use consumer products is important for accurately characterizing exposures to chemicals in the products. ORD is developing an Agent-Based Model (ABM) that simulates longitudinal patterns in exposure-related behaviors. By basing the ABM upon a needs-based artificial intelligence system, exposure assessors can predict any number of behaviors in an internally consistent manner.

33. LCHEM: Rapid Estimation of Life Cycle Inventory

A significant challenge to using life cycle assessment (LCA), for instance in alternative assessments or to address the environmental sustainability of chemicals during chemical design and manufacturing, is the large amount of reliable material and energy flow data needed to support assessments. This contribution provides methods for determining the life cycle inventory (LCI) of necessary process data that enable alternative chemical assessments, including Top-Down Data Mining methods that use EPA facility-based data and Bottom-Up Simulation methods, which together constitute the Chemical & Material Data Library (CMDL). The CMDL preferentially employs chemical specific data and uses data from larger categories of chemicals when necessary to feed data into the Consumer Product – Life Cycle (CP-LC) Analyzer, which connects LCI data into life cycle impact assessment and human exposure modeling for alternative chemical assessments.

34. LCHEM: Conceptual Framework of the Life Cycle – Human Exposure Modeling Project

A conceptual framework is presented to integrate Life Cycle Assessment (LCA) human health impact assessment with screening level risk assessment (RA) approaches to extend LCA to include near-field chemical sources (e.g., the use phase of consumer products) that have traditionally been excluded from LCA. A new generation of rapid human exposure modeling and high-throughput toxicity testing is transforming chemical risk prioritization and provides additional opportunities for expanding the set of substances evaluated within this framework. A case study integrating LCA and screening level RA provided a better understanding of the necessary research and development of tools and methods to support decision-making on the use of chemicals in products.

Ecological Modeling

35. EcoMod: Improving internal and spatially explicit external dose methods for ecological modeling

Chemical ecological risk assessments require data and models to predict exposure and effects for many species of interest within the US. This research task focuses on parsimonious methods to improve the estimation of chemical/ toxicological properties, environmental concentration, contaminant dose, and biological endpoint nodes of the ecological risk assessment conceptual framework. This research therefore focuses on reducing these dimensions for regulatory decision-making while still accounting for spatial features associate with specific ecosystems.

36. EcoMod: Sacramento River Basin pesticide assessment case study for federally listed species:

EPA is required to assess impacts to approximately 2000 listed and candidate species for every pesticide registered in the United States. This research task integrates exposure and effects approaches into ecological risk assessments to provide a probabilistic assessment of pesticide risks to threatened and endangered (listed) species. The case study is located in the Sacramento River Basin in California and evaluates the potential risk of a diversity of pesticides to 10 listed species, representing fish, amphibians, and crustaceans.

37. EcoMod: Organism and population-level ecological models for chemical risk assessment

Ecological risk assessment typically focuses on animal populations as endpoints for regulatory ecotoxicology. Scientists at USEPA are developing models for animal populations exposed to a wide range of chemicals from pesticides to emerging contaminants. Modeled taxa include aquatic and terrestrial invertebrates, fish, amphibians, and birds, and employ a wide range of methods, from matrix-based projection models to mechanistic bioenergetics models and spatially explicit population models.

CSS STAR Grants

38. Organotypic Culture Models for Predictive Toxicology Centers

EPA's National Center for Environmental Research is supporting 4 STAR Centers for research and development of Organotypic Culture Models (OCMs) that provide innovative micro-physiological systems, advance the understanding of underlying cellular consequences linking Molecular Initiating Events to AOPs. These are leading to mid- to high-throughput assays capturing responses to chemicals or their metabolites while simulating complex biological systems' response to chemical substances. The four university-based OCM Centers are collaborating with EPA scientists on creating OCMs enabling to meet human health risk screening needs.

39. STAR: Indoor Chemical Exposure: Novel Research for the 21st Century

The US EPA National Center for Environmental Research is supporting five Science to Achieve Results (STAR) grants on New Methods in 21st Century Exposure Science. Researchers from Virginia Polytechnic Institute and State University and the University of Michigan have developed new devices and methods for rapid, portable measurement of SVOCs indoors. The University of California Davis, Duke University, and University of California San Francisco also made substantial contributions to measuring SVOC exposure in indoor dust, exposures in children, and exposures to pregnant women.

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SeqAPASS (*Wednesday*)

US EPA's Sequence Alignment to Predict Across Species Susceptibility (SeqAPASS; https://seqapass.epa.gov/seqapass/), is a publically available online tool for evaluating molecular target conservation as a means to predict chemical susceptibility across taxa. With knowledge of the protein target(s) with which a chemical interacts to produce its effect and a recognized sensitive species, the SeqAPASS tool can be queried to compare millions of protein sequences from thousands of species to identify those most similar to the query sequence. This evaluation assumes that the more similar a chemical's molecular target is to a known sensitive species, the more likely the chemical can interact with that similar protein in another species and therefore provides a line of evidence to predict potential chemical susceptibility.

AOP Wiki 2.0 (*Wednesday*)

The AOP-Wiki is currently the authoritative, internationally harmonized, and publically accessible source of adverse outcome pathway description. The AOP-Wiki (1.0), originally released in September 2014, is scheduled for a major new release in November 2016. This will improve usability, remove the lag that exists in the current system for a change to propagate to linked pages, and enable more wiki content to be available programmatically starting in 2017. New features will be demonstrated, and BOSC members will be shown how to access a preview version of the AOP-Wiki 2.0 prior to its release.

ECOTox (*Wednesday*)

The US EPA's ECOTOXicology Knowledgebase (ECOTOX) is a publically available, on-line ecotoxicological effects database that provides access to data from both aquatic and terrestrial wildlife, including plants. ECOTOX has long been the source of toxicity data for Agency risk assessments and research and is used globally by numerous regulatory and research entities. Recent advances in information technology, data mining, and informatics are being integrated into ECOTOX to improve the efficiency of the system and to enhance the usability and accessibility of the data. For example, improvements in interoperability of ECOTOX with other EPA tools developed in the CSS research program (e.g., Chemistry Dashboard) are critically important to linking multiple data platforms, thereby allowing for novel analyses. These include new data visualization techniques, which are useful for AOP discovery and development efforts across the CSS program.

Virtual Tissue Laboratory System (*Wednesday*)

The Virtual Embryo research effort in CSS 17.02 and the Children's Environmental Health (CEH) Roadmap aims to build and deploy computer models that are numerically responsive to perturbation and parallel in nature, enabling a deep understanding of complex adaptive systems such as a developing human embryo. The Virtual Tissue Laboratory System (VT-LS) provides a

computational infrastructure. This presentation will demonstrate the use of VT-LS to integrate data from ToxCast with knowledge of embryology and cellular agent-based models for high-performance computing. The system encapsulates an open-source tool for modeling tissues (CompuCell3D.org) with local tools to drive the simulations (MorphMan, e-libraries) and hosts computer simulation models for quantitative prediction of developmental toxicity.

EPA Chemistry Dashboard (*Thursday*)

The EPA Chemistry Dashboard integrates data from across various NCCT web apps to deliver access to data associated with ~720,000 chemicals. These data include experimental and predicted physicochemical property, bioassay, exposure, product and functional use data. Flexible search functionality supports scientists seeking data related to chemicals in commerce and in the environment.

The Chemicals and Products Database (CPDat) (*Thursday*)

CPDat is a publically available repository of composition and related data on 16,000 consumer products that contains information on a total of 75,000 ingredients. It builds on the first generation of product databases (CPCPdb and CPCat), adds data from newly identified public sources product composition, and includes the results of new research on product composition. CPDat establishes harmonized product categories, includes predicted and reported weight fractions for ingredients, and includes data on the functions that specific ingredients serve in products..

RapidTox (*Thursday*)

RapidTox is a new project that is bringing together public data and models on tens of thousands of chemicals to enable rapid, first-order risk assessments, primarily for data poor chemicals. The dashboard provides an easy-to-use user interface into the databases and models. Currently available data domains are physchem, in vitro (ToxCast and others), in vivo, chemical use and exposure, and the open literature.