

# CSS Pathways: Anticipating Impacts of Chemicals

CHEMICAL SAFETY FOR SUSTAINABILITY RESEARCH UPDATE

## Table of Contents

CSS Highlights.....	2
EPA Hosts Exposure Science in the 21st Century Grantees Meeting   Research Triangle Park, NC .....	2
NAS Kickoff Meeting for New study: Incorporating 21st Century Science in Risk-Based Evaluations .....	3
EPA Releases Online Tool to Prioritize Chemicals for the Endocrine Disruptor Screening Program.....	4
Children’s Environmental Health: .....	5
EPA Scientists Research Asthma Biomarkers for Children’s Health.....	5
Recent Results from Nanomaterials Research:.....	6
Effects of Sunlight to the Properties of Graphene Oxide .....	6
Influence of Exposure Conditions on Phototoxicity and Species Sensitivity to Titanium Oxide .....	7
Pushing the Frontier of Exposure Science: .....	8
Rapid Exposure and Dosimetry.....	8
Chemical Category Product Database.....	9
Upcoming & Recent Events.....	10
Society of Toxicology (SOT) 2015 Annual Meeting   San Diego, CA .....	10
Grantees Corner.....	11
An Update from EPA’s STAR Grantees: MODRN.....	11
Organotypic Culture Models for Predictive Toxicology Centers Grants Announcement & Kickoff at Society of Toxicology Annual Meeting   San Diego, CA .....	12
CSS in the News.....	13
Recent News Articles .....	13
EPA Blogs Feature CSS Research.....	14
Recent CSS Blog Posts .....	14
Meet CSS Scientists.....	15

## CSS Highlights

### EPA Hosts Exposure Science in the 21st Century Grantees Meeting | Research Triangle Park, NC

EPA hosted the New Methods in 21<sup>st</sup> Century Exposure Science Grantees Kickoff meeting in Research Triangle Park, NC on February 3-4, 2015. EPA's Chemical Safety for Sustainability Research Program and National Center for Environmental Research, through the Science to Achieve Results (STAR) grant program, awarded \$4.5 million to five universities to conduct innovative research to advance methods for characterizing real-world human exposure to chemicals associated with consumer products in indoor environments. The meeting provided an opportunity to publicly announce the grant recipients and to facilitate collaborations among them and the EPA exposure scientists. The meeting culminated in a panel discussion on day two that probed perspectives on the disconnect between findings from epidemiological studies and toxicology/toxicity testing, germinating a discussion on how this gap can be bridged to enable decisions that are public health protective.

Grant recipients:

- **University of California, San Francisco**—Principle Investigator: *Tracey Woodruff Ph.D.*
- **Duke University**—Principle Investigator: *Heather M. Stapleton Ph.D.*
- **University of California, Davis**—Principle Investigator: *Deborah H. Bennett Ph.D.*
- **Virginia Tech**—Principle investigator: *John Little Ph.D.*
- **University of Michigan**—Principle Investigator: *Xudong Fan Ph.D.*



## NAS Kickoff Meeting for New study: Incorporating 21st Century Science in Risk-Based Evaluations

One of the goals of CSS' new strategic plan is to develop approaches for integrating advances in toxicity testing and exposure science to accelerate the pace and enhance the predictive capacity of risk-based evaluations. To this end, EPA requested guidance from the National Academy of Sciences (NAS) on how to foster this integration and take advantage of the broader spectrum of 21<sup>st</sup> Century science emerging from diverse research fields including biotechnology and computational sciences. On January 26, the NAS convened a committee and hosted a public meeting to discuss the progress made since the publication of previous NAS reports, including *Toxicity Testing in the 21<sup>st</sup> Century*, *Science and Decisions*, and *Exposure Science in the 21<sup>st</sup> Century*. Presentations by Bob Kavlock (EPA ORD), Linda Birnbaum (NIH/NIEHS/NTP), Chris Austin (NIH/NCATS), David White (FDA), and Dan Krewski (U of Ottawa) generated a vibrant discussion among committee members, who acknowledged the unprecedented opportunity offered by the current state of scientific and technological advances.



## EPA Releases Online Tool to Prioritize Chemicals for the Endocrine Disruptor Screening Program

Congress requires EPA's [Endocrine Disruptor Screening Program](#) to evaluate chemicals for potential endocrine disruption and there are thousands of chemicals of interest to the program. To facilitate this review, EPA researchers developed an interactive dashboard, EDSP21 Dashboard, which provides easy access to new data on over 1,800 chemicals of interest. The publicly available [EDSP21 Dashboard](#) includes: chemical information (structure, CASRN, molecular weight, etc); an aggregated listing of all publicly available resources that have information about the chemicals; biological activity data from rapid, automated (high-throughput) screening technologies; high-throughput exposure information (including exposure predictions and chemical product category information); and descriptions of the high-throughput screening assays.



## **Children's Environmental Health:**

### EPA Scientists Research Asthma Biomarkers for Children's Health



Asthma has many different subtypes each of which are impacted to varying degrees by genetic susceptibility and changing environmental factors, resulting in complicated treatment and diagnostic processes. In this cross-sectional study of asthmatics in Detroit, MI, researchers developed a purely data-driven approach to describe four distinct asthma subtypes. Using a method that integrates blood gene expression and clinical biomarkers, they provided new insights into the importance of integrated approaches in evaluating diseases with complex etiologies. The full article is available on the [journal website](#).



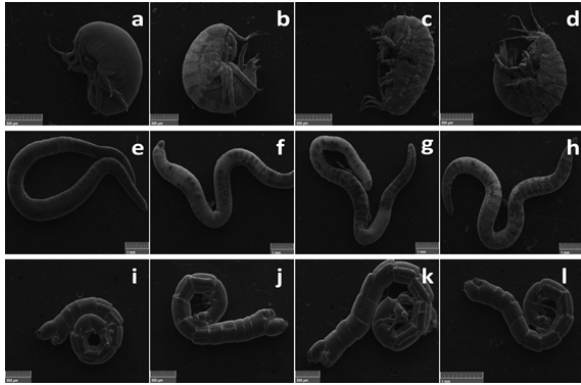
## Recent Results from Nanomaterials Research:

### Effects of Sunlight to the Properties of Graphene Oxide

The Journal of *Environmental Science & Technology* has newly accepted “Photochemical transformation of graphene oxide in sunlight” for publication. This paper describes recent research on the photochemical fate of graphene oxide (GO) under environmentally relevant sunlight conditions. As a precursor to graphene—a widely used and promising nanomaterial—it is important to examine potential risks to ecosystems posed by GO, other nanomaterials, and their derivatives. The results of this particular study indicate rapid transformation of GO properties under sunlight that results in chemically reduced and persistent photoproducts that are likely to present transport and toxic properties unique from the original GO. The full publication can be found on the [journal website](#).



## Influence of Exposure Conditions on Phototoxicity and Species Sensitivity to Titanium Oxide



EPA researchers published the paper, “Species sensitivity and dependence on exposure conditions impacting the phototoxicity of TiO<sub>2</sub> nanoparticles to benthic organisms”. Understanding how exposure to ultraviolet light impacts the toxicity of nanoparticles will help inform the development of test guidelines and risk assessments for nanomaterials. Assays representing three organisms (*Lumbriculus variegatus*—type of worm, *Hyalella azteca*—a type of crustacean and *Chironomus dilutus*—type of bug) were exposed to TiO<sub>2</sub> while increasing the levels of ultraviolet light intensity. *Hyalella azteca* (crustacean) was found to be the most sensitive of the three

species. The exposure scenario with the least bioavailable TiO<sub>2</sub> had lower mortality. The [complete paper](#) is available online.



## Pushing the Frontier of Exposure Science:

### Rapid Exposure and Dosimetry

The *Environmental Science and Technology* journal published “SHEDS High-Throughput: An Integrated Probabilistic Exposure Model for Prioritizing Exposures to Chemicals with Near-Field and Dietary Sources”. The paper describes a new nearfield SHEDS-HT (Stochastic Human Exposure and Dose Simulation- High-Throughput) model. Developed using EPA’s SHEDS-MM (Multimedia, Multipathway) model, SHEDS-HT produces exposure estimates for thousands of chemicals in a more rapid and cost-effective manner. SHEDS-HT accounts for multiple routes, scenarios, and pathways of exposure to understand the total exposure to these chemicals while retaining population and life stage information. The paper reports on the analysis and results from the model for 2,507 organic chemicals associated with consumer products and agricultural pesticides. The complete article can be found on the [journal website](#).





## Chemical Category Product Database



A major challenge in estimating chemical exposures is to understand which chemicals are present in consumer products, homes, the workplace, food, soil and the air. The “Exploring Consumer Exposure Pathways and Patterns of Use for Chemicals in the Environment” paper describes the [Chemical/Product Categories Database \(CPCat\)](#), a new, publically available database of information on chemicals mapped to “use categories” describing the usage or function of the chemical. CPCat was created by combining multiple and

diverse sources of data on consumer—and industrial—process based chemical uses from regulatory agencies, manufacturers, and retailers in various countries. The database uses a controlled vocabulary of 833 terms and a novel nomenclature to capture and streamline descriptors of chemical use for 43,596 chemicals from the various sources. Examples of potential applications of CPCat are provided, including identification of chemicals to which children may be exposed and support for prioritization of chemicals for toxicity screening. The [complete article](#) can be found online.

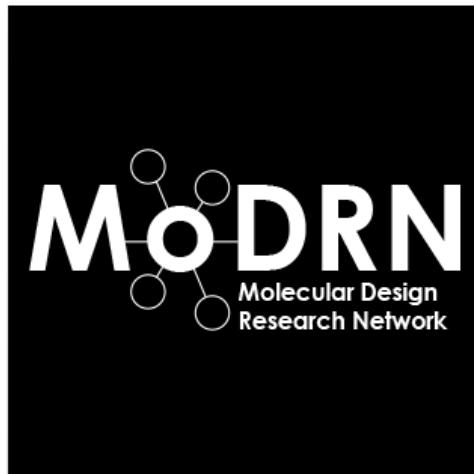


## Upcoming & Recent Events

### Society of Toxicology (SOT) 2015 Annual Meeting | San Diego, CA

Many EPA scientists will showcase their research through symposia, workshops, platform presentations and poster sessions at the 2015 SOT 54<sup>th</sup> Annual Meeting and ToxExpo in **San Diego, March 22-26, 2015**. EPA will host several special events in conjunction with SOT including a Science to Achieve Results (STAR) grantee kick-off meeting (see story below) and will also have an exhibit booth at the conference to distribute informative research factsheets as well as information about career and grant opportunities. This year EPA will once again hold “Meet the Director Sessions” and demonstrations of online research tools at booth #2133. For a full schedule of booth activities visit the [EPA SOT webpage](#). More information about the SOT Annual Meeting and complete conference materials are available on the [SOT conference webpage](#).





### An Update from EPA's STAR Grantees: MODRN

The Molecular Design Research Network (MoDRN) is a Green Chemistry and Green Engineering initiative that focuses on the rational design of chemicals and materials to reduce toxicity. In recent years, there has been growing concern over the safety of commercial chemicals and their unintended biological activity in both the public sphere and scientific community. Given this concern, a goal of the research at MoDRN is the elucidation of design guidelines for next-generation molecules with reduced hazard. These design guidelines will be incorporated into computational chemistry approaches, so-called in silico models, and therefore reduce the economic and ethical costs of in

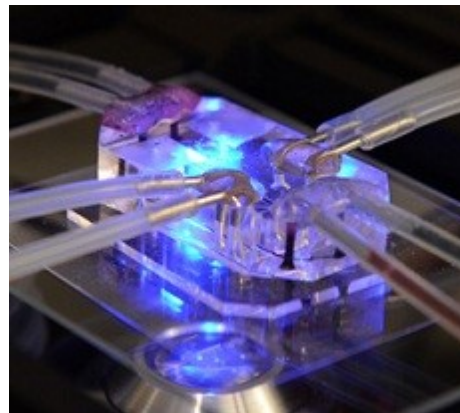
vivo screening of new molecules for adverse biological outcomes.

To date, the researchers from MoDRN have developed a first-generation in silico model that not only predicts toxicity, but also can be used to inform the design of new molecules. The prediction software is now being validated using existing data sets and will be further validated by extensive toxicological studies using in vitro and aquatic models (e.g., zebrafish, fathead minnow, daphnia). These and other advances in safer chemical design will be presented at the ACS-MoDRN co-hosted session at the 250th ACS National Meeting in Boston, and at the 2-day workshop “The Nexus of Toxicology and Chemistry” sponsored by MoDRN.



## Organotypic Culture Models for Predictive Toxicology Centers Grants Announcement & Kickoff at Society of Toxicology Annual Meeting | San Diego, CA

During the 2015 SOT Annual Meeting, EPA's National Center for Environmental Research (NCER) and CSS will host a **grantee kickoff** event on **March 25 (5:00-7:00pm PST)** to announce and congratulate the grantees receiving Science to Achieve Results (STAR) grants. These research institutions will develop and evaluate Organotypic Cell Models (OCMs) for high-priority biological systems such as the brain, liver, kidney, testis, breast tissue, heart and neurovascular. OCMs, sometimes called 'organ-on-a-chip' are in vitro systems of three-dimensional cultures of two or more cells that will model biological interactions from a complex organ or tissues. OCMs can be used as a testing platform for research into the interactions of chemicals with important biological processes and provide new biological insight as to how tissues and organs function during chemical exposures. When developed and evaluated, OCMs will provide information needed to help predict chemical toxicities in human tissues. More information about this event can be found [here](#). Anyone with an interest is welcome to attend.





## Recent News Articles

- [Health Effects of Low Doses of Chemicals Subject of EPA Query to National Academies](#)
- [EPA Seeks NAS Study on Whether Toxicity Tests Address Low Dose Risks](#)



# EPA Blogs Feature CSS Research

## Recent CSS Blog Posts



- [EPA: Taking Action on Toxics and Chemical Safety](#)
- [Advancing Species Extrapolation: “EPA’s Sequence Alignment to Predict Across Species Susceptibility”](#)
- [Exposing the Missing Link: Advancing Exposure Science to Rapidly Evaluate Chemicals](#)



# Meet CSS Scientists

- [Tina Bahadori](#)
- [Tom Knudsen](#)
- [Bill Mundy](#)
- [Sandy Raimondo](#)
- [Tim Shafer](#)
- [Dan Villeneuve](#)

