Exposure to sub-lethal levels of copper does not suppress the ability of Zebrafish (Danio rerio) to detect an aversive odorant

Poster (Friday, April 20, 2018)

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The EPA currently lists copper as a priority pollutant under the US Clean Water Act. Copper is prevalent in freshwater ecosystems due to human inputs from agricultural runoff, mining activities, and treatment plants. To test the effects of copper contamination on the olfactory system of freshwater fish, we exposed adult zebrafish (Danio rerio) to a sub-lethal dose of 80 ppb copper for 24 hours then tested their ability to detect the aversive odorant L-cysteine in a dual flume system. Accumulated time spent in each side of the flume was measured using a customized computer software which recorded the position of the fish. Time spent in each side of the flume was compared between copper-exposed and control fish. Both copper-exposed and control fish spent significantly less time in the side of the flume where the aversive odorant was placed. Exposure to copper at a concentration of 80 ppb for 24 hours did not suppress the ability of zebrafish to detect and respond to the presence of L-cysteine. Our results do not preclude the possibility that prolonged exposure to copper could affect the ability of zebrafish to detect and respond to L-cysteine.

The Effects of Urbanization on Bee Species in Comparison to Rural Prairie and The Affects It has on The Bee Branch Watershed

Poster (Friday, April 20, 2018)

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Pollinators are a keystone species in all terrestrial ecosystems; they help create plant diversity and abundance. Native bees are responsible for eighty percent of all flowering plants and seventy-five percent of all fruits, nuts, and vegetables that grow in this country, yet research examining bee diversity in urban areas is lacking. This project established plots in both prairie and urban areas of Dubuque County to address these differences. We set 1-hectare plots within Dubuque prairies and Dubuque urban areas to determine if 1) urban areas affect the diversity of bee population, and 2) are bee populations healthy enough in the city to help the restoration process of the Bee Branch Watershed. There were population differences between the Dubuque prairie and Dubuque urban areas. Urban captures represented only 11% of the prairie captures. This may be caused by reduced open spaces in urban areas that pollinators need to survive. Over 50% of captures occurred in suburban areas like parks and backyards. Monthly differences also occurred with a greater number of bees captured during July than other months. These numbers are helpful for revitalizing the community's neighborhood and the restoration of the Bee Branch Watershed.

The Involvement of the Aryl Hydrocarbon Receptor in the Toxicity of Polychlorinated Biphenyls

Poster (Friday, April 20, 2018)

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The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor involved in the regulation of biological responses to planar aromatic hydrocarbons, and regulates xenobiotic-metabolizing enzymes. Our previous results showed that dioxin-like polychlorinated biphenyl (PCB) congeners like PCB126 binds avidly to the AhR. Our hypothesis is that toxic manifestations following exposure to PCB126 are mediated through the AhR. To test this, we created AhR knock out (AhR-KO) model using CRISPR/Cas9 to compare wild type (WT) male and female Holtzman Sprague Dawley rats with AhR-KO rats. After 28 days of injection by a single IP dose of corn oil vehicle or PCB126 in corn oil, organs were collected by necropsy to analyze the expression of genes and changes leading to histopathology. Significant decrease in body-weight, relative thymus, and absolute liver weights were observed in WT rats compared to AhR-KO rats. Unlike AhR-KO rats, the expression of genes encoding enzymes related to xenobiotic and intermediary metabolism, and levels of whole blood glutathione were altered, and serum glucose was decreased in WT rats. Therefore, all adverse manifestations were observed in WT rats, and not in AhR-KO rats, indicating the direct involvement of the AhR in the mediation of toxicity due to PCB 126 exposure.

Primary and secondary sources of ambient particulate matter in the Kathmandu Valley, Nepal

Oral (Saturday, April 21, 2018)

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Kathmandu Valley, the capital of Nepal, suffers from severe air quality problems, due in part to particulate matter (PM). In this study, we use molecular markers to identify and quantify PM sources in Kathmandu from April 11-24, 2015. The concentration of PM2.5 (particles with diameters < 2.5 µm) ranged 30.0-207.4µg/m3, all of which exceeded the World Health Organization 24-hour guideline of 25 µg/m3. PM2.5 was comprised in part by water-soluble ions, including sulfate (16%), ammonium (9%), nitrate (4%), indicating
secondary inorganic aerosol contribution, as well as calcium (1.2%) and magnesium (0.1%), reflecting airborne soil dust. Major fractions of PM2.5 were organic carbon (27%) and elemental carbon (13%) that originate from combustion and secondary processes. To gain further insight to sources of organic carbon, gas chromatography coupled to mass spectrometry was used to quantify molecular markers that are indicative of PM sources such as garbage burning, biomass and dung burning, fossil fuel combustion, biogenic and anthropogenic secondary organic aerosol, etc. Preliminary source apportionment using chemical mass balance modeling indicated garbage burning (18%), biomass burning (17%), gasoline and diesel engines (18%) as major sources of PM2.5 organic carbon.

What can we learn from rapid particle measurements during the Lake Michigan Ozone Study 2017 (LMOS 2017)

Oral (Saturday, April 21, 2018)

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The field campaign, Lake Michigan Ozone Study 2017, combined ground, mobile, aircraft, and ship measurements to better understand the regional and local summertime ozone episodes. The population of aerosols at the main ground site (Zion, IL) was continuously monitored using electrical particle counters with size measurement capabilities (Scanning Mobility Particle Sizer (SMPS) and Aerodynamic Particle Sizer (APS)).

These continuous measurements are useful because they show how rapid events (smoke, dust, other pollution types, and wind shifts) impact the site. Here we compare them to integrated aerosol filters taken on site, which are more accurate but do not record rapid values.

The 12 hr average of SMPS+APS PM2.5 concentrations were well correlated with the filters, the mean concentrations were 5.71 µgm-3 and 5.17 µgm-3 respectively, and a correlation coefficient (r) of 0.89. High ozone events, exceeding 70 ppb, occurred June 2nd and June 10-16. The PM2.5 was averaged over every hour of event and non-event days where the concentrations, and hour, were 11.4 µgm-3 (19 UTC) and 5.9 µgm-3 (04 UTC) respectively. A significant diurnal variation of PM2.5 and total number concentrations were observed during the event periods, peaking in the late afternoon, but not during the non-event periods.