Exposure Assessment Facility

ENVIRONMENTAL HEALTH SCIENCES RESEARCH CENTER

THE UNIVERSITY OF IOWA

Facility Goal

The overarching goal of the Exposure Science Facility (ESF) is to facilitate the research efforts of EHSRC investigators as they seek to understand the external environmental stressors that adversely affect outcomes following an exposure.

Facility Services

Cost-effective instrumentation lending service

Expertise in measuring and analyzing environmental contaminants

Guidance on modeling and display of contaminants and affected populations

Facility Research

Modeling

- Computational Fluid Dynamic (CFD) modeling of human airways
- Dispersion modeling of ambient air contaminants

Environmental Monitoring

Environmental Contaminant Analytical Analysis

Personnel

Patrick O'Shaughnessy, PhD	Director
Hans Lehmler, PhD	Investigator
Ching-Long Lin, PhD	Investigator
Thomas Peters, PhD	Investigator
Ralph Altmaier, MS	Coordinator/modeler

Instruments and Software

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Sampling

- Aerosol Monitors
- Gas and Air Monitors
- Recording Devices and Computers

Modeling Software

- Plume Dispersion - AERMOD
- Computational Fluid Dynamics

PM Sampling Trailer

Exposure Assessment Instruments

- Aerosol measurement
  - Particle counters, gravimetric samplers, size-distribution analyzers, sieves
- Airflow calibrators and pressure sensors
- Gas and air measurement
  - Temperature, humidity, H_2S, NH_3, NOx, multi-gas meters
- Meteorological stations
- Recording devices and computers
  - PCs, cameras, camcorders, dataloggers
- Sampling pumps
  - Personal and high-volume

ESF Lab Sampling Chamber

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Air Flow From Dedicated Blowers

Analog and Digital Flow Rate and Static Pressure Sensors

Ports for sample lines or solenoids to turn on/off samples

Analytical Equipment & Facilities

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Sample Analysis – In House

- GC and HPLC
- Accelerated Solvent Extraction System

Ties to University Facilities

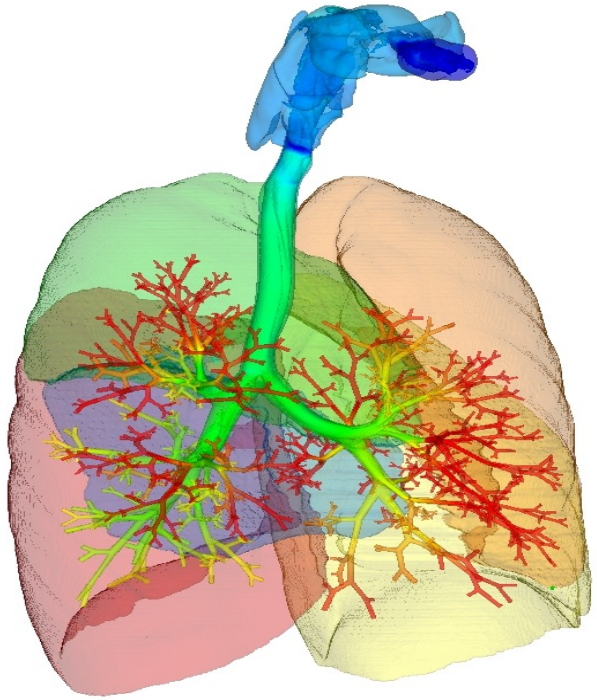
- Central Microscopy Research Facility
- High Field Nuclear Magnetic Resonance Facility,
- High Resolution Mass Spectrometry (HRMS) Facility,
- State Hygienic Laboratory (SHL)

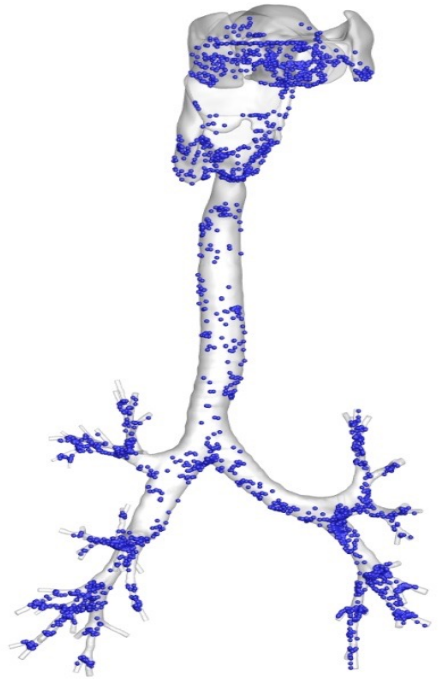
Computer Modeling

CHING-LONG LIN

PATRICK O'SHAUGHNESSY

Computational Fluid Dynamics





Lambert A, **O'Shaughnessy PT**, Tawhai M, Hoffman E, **Lin CL**. (2011) Regional deposition of particles in an image-based airway model: Large-eddy simulation and left-right lung ventilation asymmetry. *Aerosol Sci Technol, 45*, 11-25

Asthma Imaging Cluster Analysis

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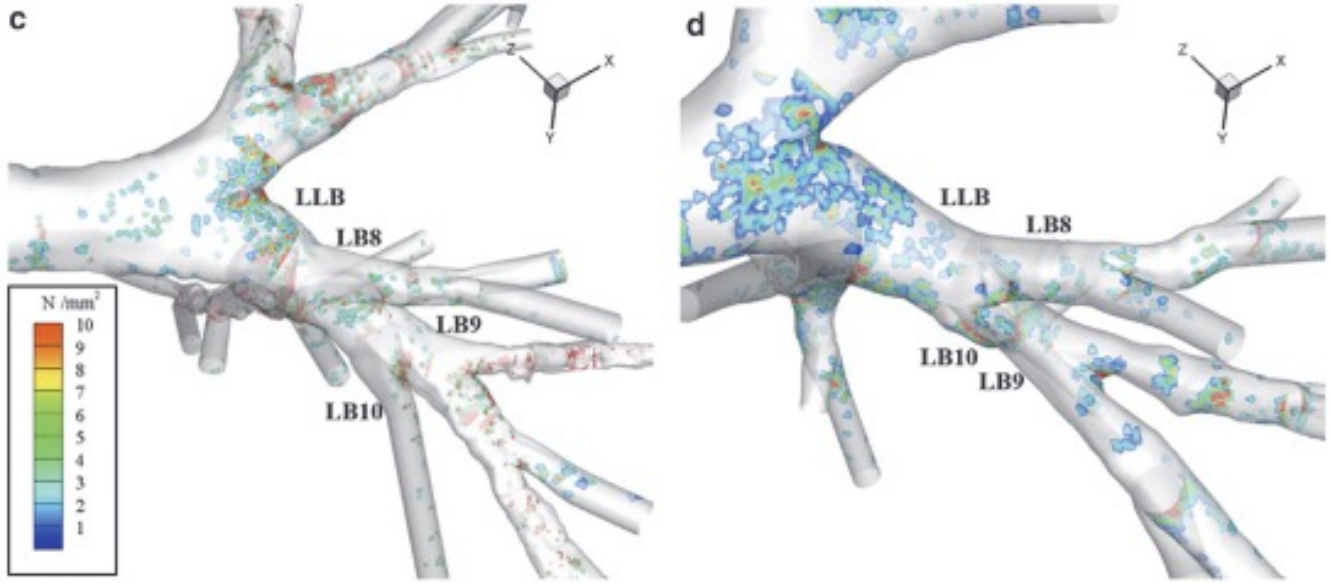
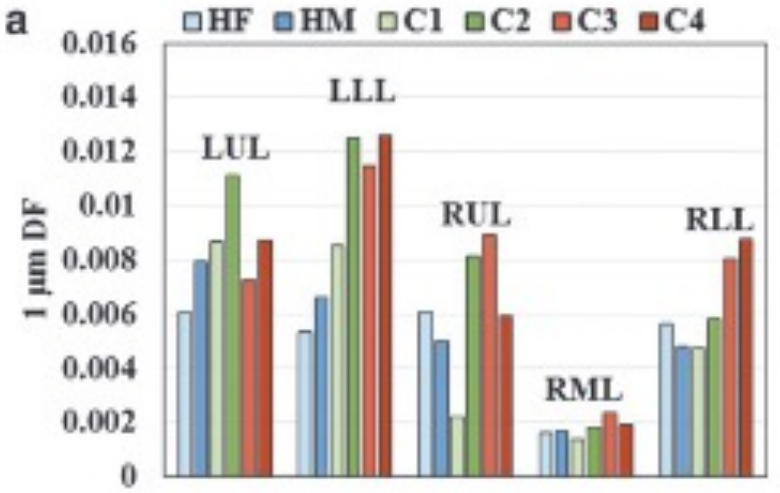


4 µm diameter particle deposition in two of four asthma clusters



Regional deposition fraction relative to healthy subjects and asthma cluster type for 1 µm particle.

Dispersion Modeling

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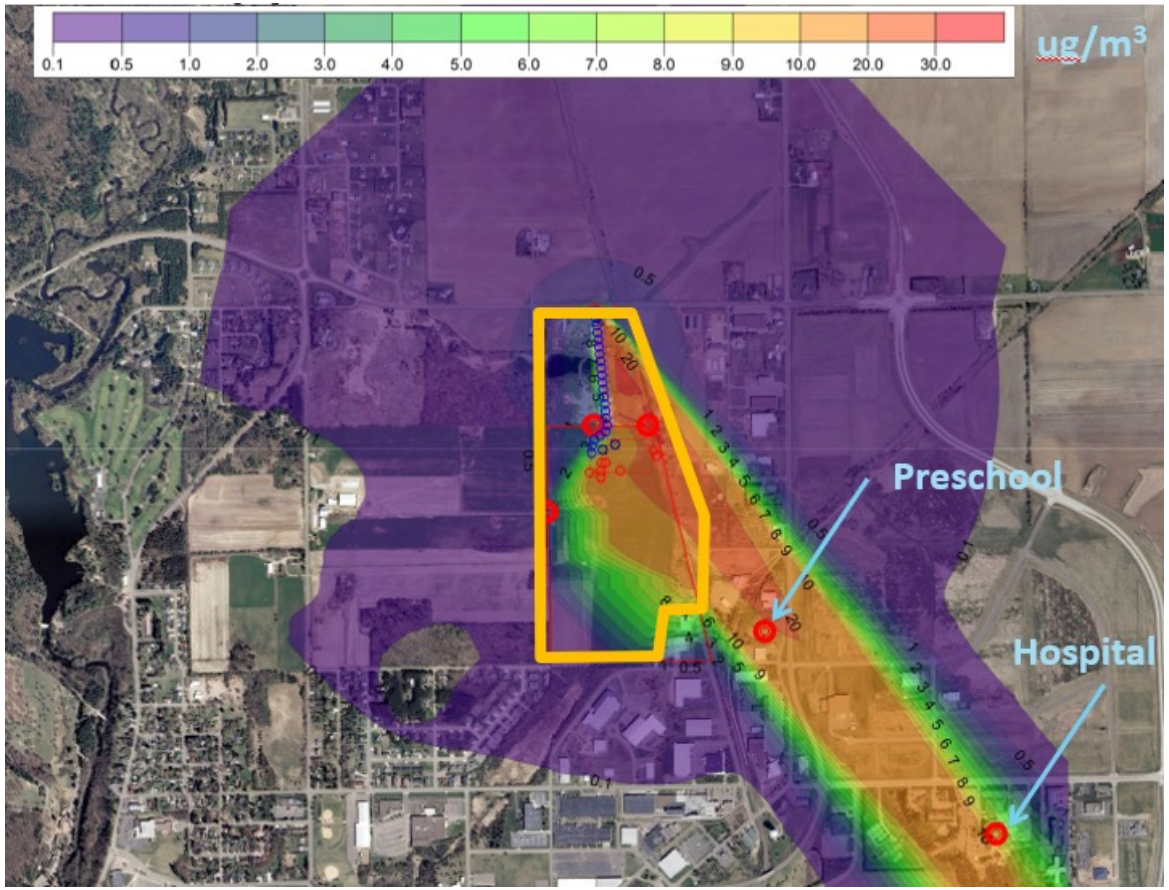
Model Results

- PM_{10}
- Maximum one-hour event in direction of receptors



Dispersion Modeling

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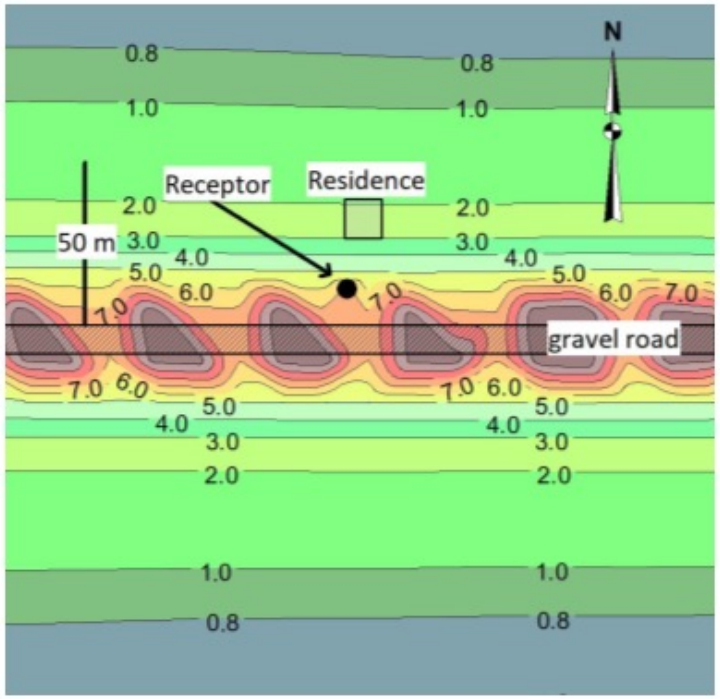
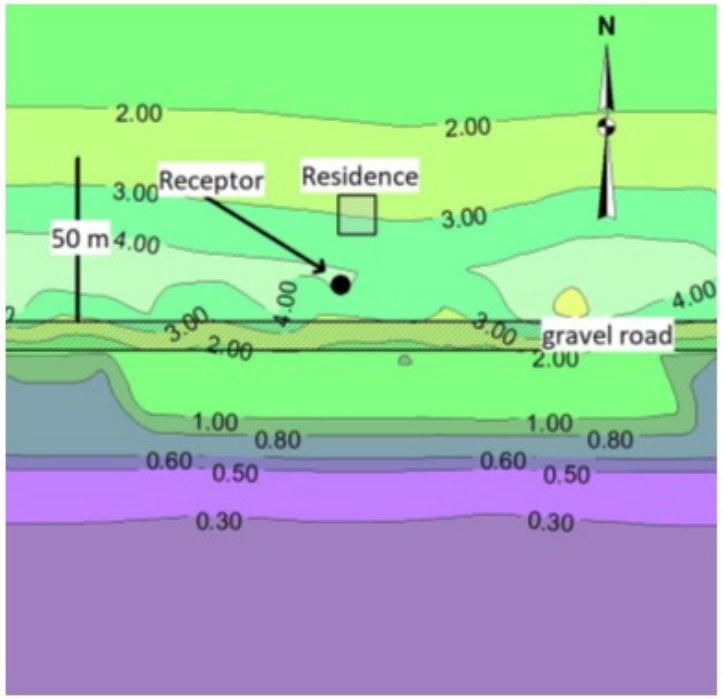


Wind speed: 1 mph
Wind direction: 225°



Wind speed: 10 mph
Wind direction: 225°

Environmental Monitoring

THOMAS PETERS

PATRICK O'SHAUGHNESSY

Ambient Sampling

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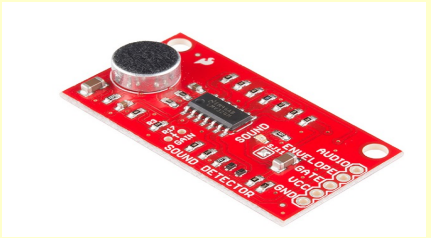
Optical particle counter measures $PM_{2.5}$ and PM_{10} every 6 sec

Ultrasonic anemometer measures wind speed and direction

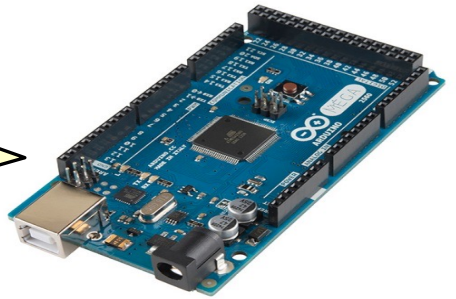
Camera takes pictures and detects motion



Microphone measures sound levels

Microcontroller

Collects data and triggers camera



Storage

Data saved onto an SD card

Ambient Sampling

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PM Sampling Trailer

- Aerosol Monitors
- Weather Station
- Gas Monitors

Community airborne particulate matter from mining for sand used as hydraulic fracturing proppant☆,☆☆

Thomas M. Peters *, Patrick T. O'Shaughnessy, Ryan Grant, Ralph Altmaier, Elizabeth Swanton, Jeffrey Falk, David Osterberg, Edith Parker, Nancy G. Wyland, Sinan Sousan, Aimee Liz Stark, Peter S. Thorne

Influence of rain on the abundance of bioaerosols in fine and coarse particles

Chathurika M. Rathnayake[1], Nervana Metwali[2], Thilina Jayarathne[1], Josh Kettler[1], Yuefan Huang[1], Peter S. Thorne[2,3], Patrick T. O'Shaughnessy[2,3], and Elizabeth A. Stone[1]

A task-based analysis of black carbon exposure in Iowa farmers during harvest

Emma M. Stapleton, Patrick T. O'Shaughnessy, Sarah J. Locke, Ralph W. Altmaier, Jonathan N. Hofmann, Laura E. Beane Freeman, Peter S. Thorne, Rena R. Jones & Melissa C. Friesen

Evaluation of airborne particulates and associated metals originating from steel slag applied to rural unpaved roads†

James Kacer, *[a] Ralph Altmaier,[a] Drew Latta,[b] Patrick T. O'Shaughnessy[a] and David M. Cwiertny [bc]

ESF Analytical Laboratory and Expertise

HANS-JOACHIM LEHMLER

View of the ESF Analytical Toxicology Laboratory

Analytical Expertise

Individual PCB analysis (GC-ECD; GC-MS)

Individual PCB and OH-PCB analysis (GC-ECD; GC-MS)

Enantioselective PCB and OH-PCB analysis (GC-ECD; GC-MS)

Congener specific PCB analysis (GC-ECD; GC-MS)

PAH analysis (GC-MS)

Pesticides analysis (GC-MS)

Nontarget analysis of PCBs and pesticides (LC-HRMS)

PCB metabolism in transgenic mouse models (R01 ES014901)

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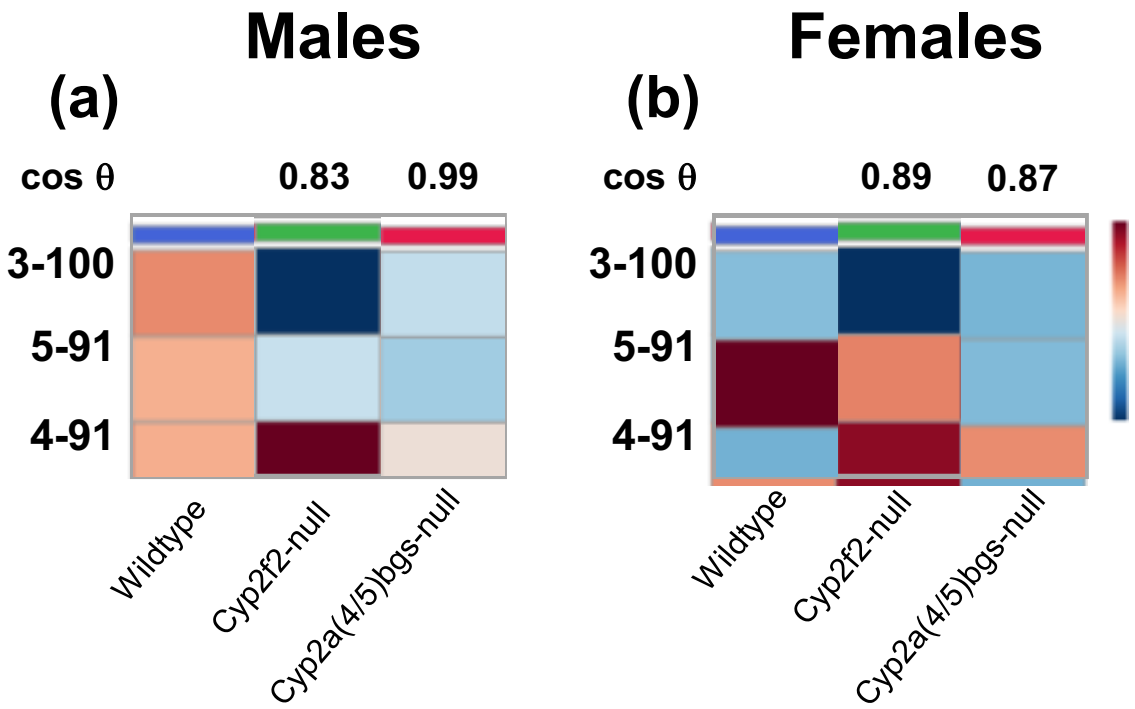
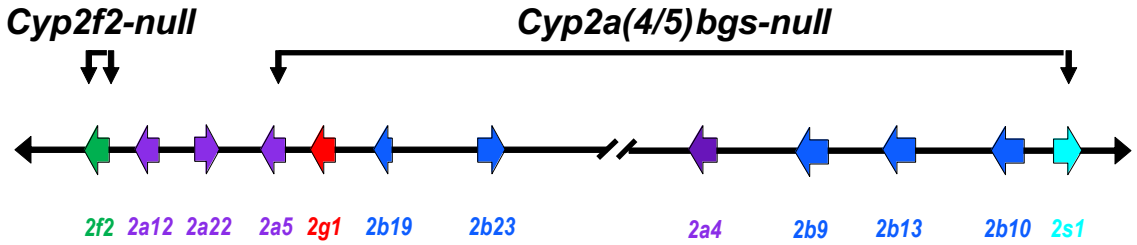


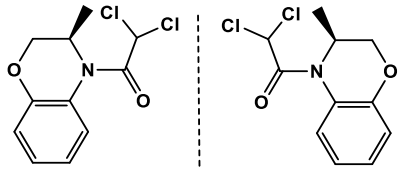
Chem. Res. Toxicol. **2022**: 35,2310-2323

PCB91 metabolite profiles formed by microsomes from *Cyp2a(4/5)bgs*-null, *Cyp2f2*-null, and wild-type mice differ across genotypes.



Mouse models used in this study. *Cyp2f2*- and *Cyp2a(4/5)bgs*-null mice were generated by deleting the indicated segments from the *Cyp2f2-2s1* cluster on mouse cytochrome 7

Metabolism of benoxacor in human sub-cellular fractions



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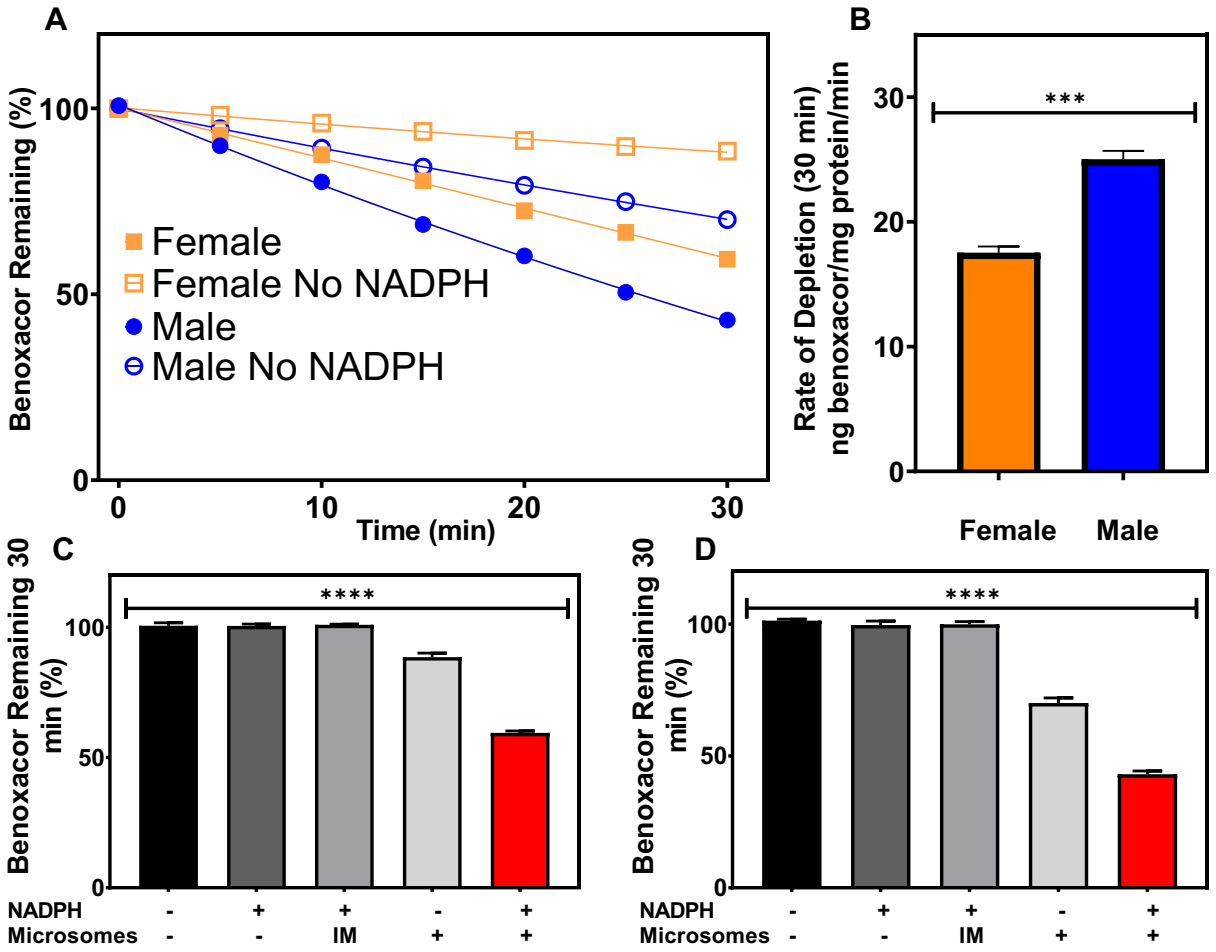

Metabolism of benoxacor in incubations with pooled microsomes from human livers.

(A) Metabolism of benoxacor with and without the addition of NADPH.

(B) Comparison of the protein-adjusted rate of depletion of benoxacor at 30 minutes for liver microsomes prepared from female and male livers.

(C) and (D) The percentage of benoxacor in microsomal incubations from female and male livers and control incubations at 30 minutes

Emerging Contaminants **2023**: *9*,100198

CBET-1702610/1703796