The Southern California Particle Center

Director: John R. Froines, Ph.D.

- University of California, Los Angeles
- University of Southern California
- University of California, Irvine
- Michigan State University
- University of Wisconsin-Madison
- University of Tsukuba, Japan

ARB, AQMD, EPA Supersite

UCLA
USC
UCIrvine
Michigan State University
University of Tsukuba
INCEER
Southern California Particle Center

- The overall objective of the Southern California Particle Center (SCPC) is to elucidate the basis for health effects from ambient particulate matter (PM) and vapor phase co-pollutants.

- Determine the physical and chemical properties of PM and vapors emitted from various sources.

- Determine the mechanistic features (roadmap) of adverse health effects beginning at the source of exposure and proceeding to disease/illness outcomes.
UCLA-Fogarty Training Program in Occupational and Environmental Health

- The UCLA-Fogarty Training Program was established to provide training to graduate students from Mexico through collaborative research with Mexican faculty.

- Since 1995, masters and doctoral students enrolled in Mexican institutions have been brought for training at UCLA.

- We have collaborated with Dr. Andrea De Vizcaya Ruiz on two major air pollution studies that were linked with our Particle Center research.

- We have also had outstanding collaboration with Dr. Horacio Riojas Rodriguez of INSP including distance learning in risk assessment.
Newly recognized health effects from our research

• Our research has shown adverse health impacts from the pollutants associated with mobile sources including diesel, rail, ships, and fixed sites
  – respiratory illnesses
  – increased risk of heart disease....

  – Adverse birth outcomes (low birth weight and preterm birth)
  – neurotoxicity
Perspective of our research

• To characterize PM and vapors for the chemical reactivities associated with adverse health effects, prooxidant and electrophilic activity.

• Focus on cellular nucleophiles, thiols and amines as targets of the reactive species

• Operating hypothesis: toxicity of a number of chemicals due to two primary reactions that determine disease outcome:
  – Oxidation of sensitive proteins and DNA by reactive oxygen species (ROS) leading to oxidative stress
  – Irreversible alkylation of reactive proteins by electrophiles present in pollutants
PM Sizes

- **PM 10**
  - Smaller than 10 microns in diameter

- **PM 2.5 - Fine particles**
  - Smaller than 2.5 microns in diameter

- **PM 0.1 - Ultrafine particles**
  - Smaller than 0.1 microns in diameter

Fine particles

Ultrafine particles
Tunnel studies: PM mass decreases; particle number increases over time

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<tbody>
<tr>
<td><strong>Bore 1</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(Mixed HDV, LDV)</td>
<td></td>
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<tr>
<td>PM10 (ug/m3)</td>
<td>130.0</td>
<td>37.2</td>
<td></td>
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<tr>
<td>PM2.5 (ug/m3)</td>
<td>115.7</td>
<td>36.7</td>
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<tr>
<td>PN (particles/cm3)</td>
<td>340,000</td>
<td>550,000</td>
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<tr>
<td><strong>Bore 2</strong></td>
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<tr>
<td>(LDV only)</td>
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<tr>
<td>PM10 (ug/m3)</td>
<td>40.0</td>
<td>19.4</td>
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<tr>
<td>PM2.5 (ug/m3)</td>
<td>40.9</td>
<td>15.3</td>
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<tr>
<td>PN (particles/cm3)</td>
<td>185,000</td>
<td>450,000</td>
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Mitochondria: An Important Subcellular Target of PM and a Source of ROS Generation

Mitochondria are redox active organelles