# Pulmonary and Systemic Immune Response to Inhaled Oil Condensates

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# Nanoparticles are a Topic of Interest

- Interest driven by a few studies, mostly with non-environmental particles
- Consideration of particle number standards
- Particle mass going down (thanks to you)
- Not certain if nanocondensates will be removed as quickly as solid “soot”
  - Limited information on hazard of this material

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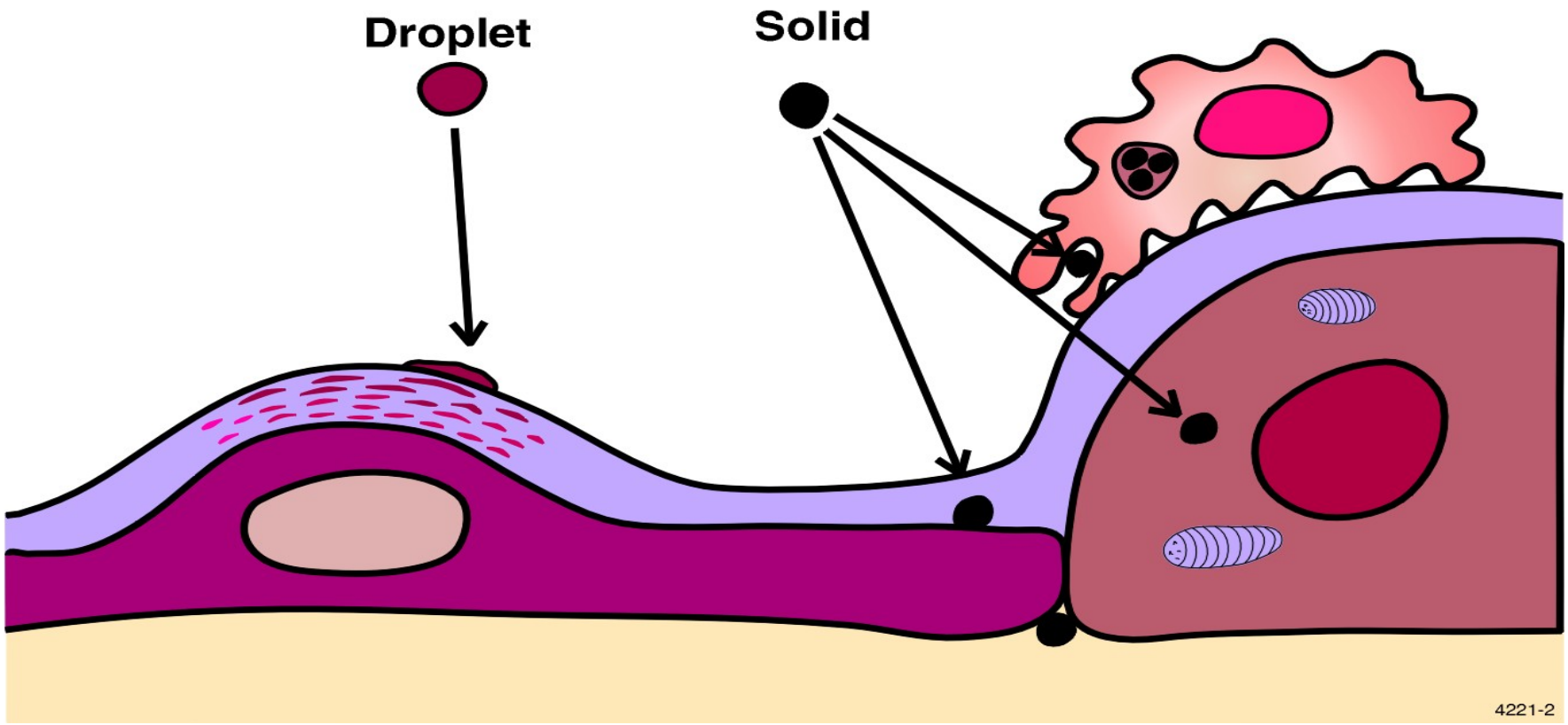
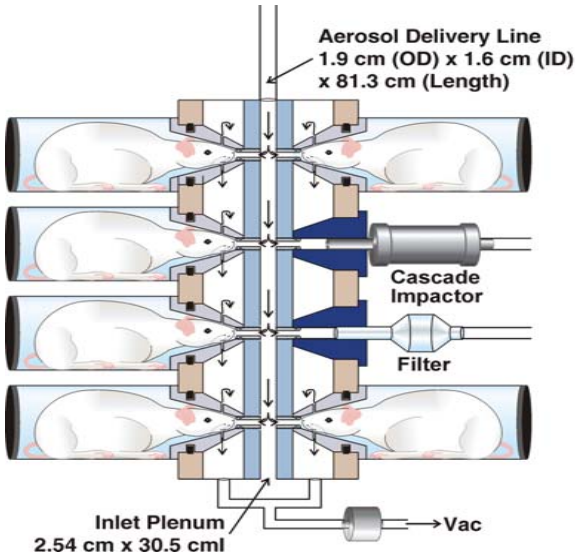
# Solid and liquid particles may “behave” differently at lung surface

**ULTRAFINES/NANOPARTICLES**



# Aerosol Exposures

- Mice exposed by nose-only inhalation 6 hr/day for 7 days (*match diesel protocols*)
- Shell Rotella-T15w-40 oil from 200 hr change in Cummins 5.9L engine on FTP cycle
- Oil nanocondensates generated by evaporation/condensation
- Diluted to target of $10^6$ particles/$cm^3$ at a <20 nm particle size

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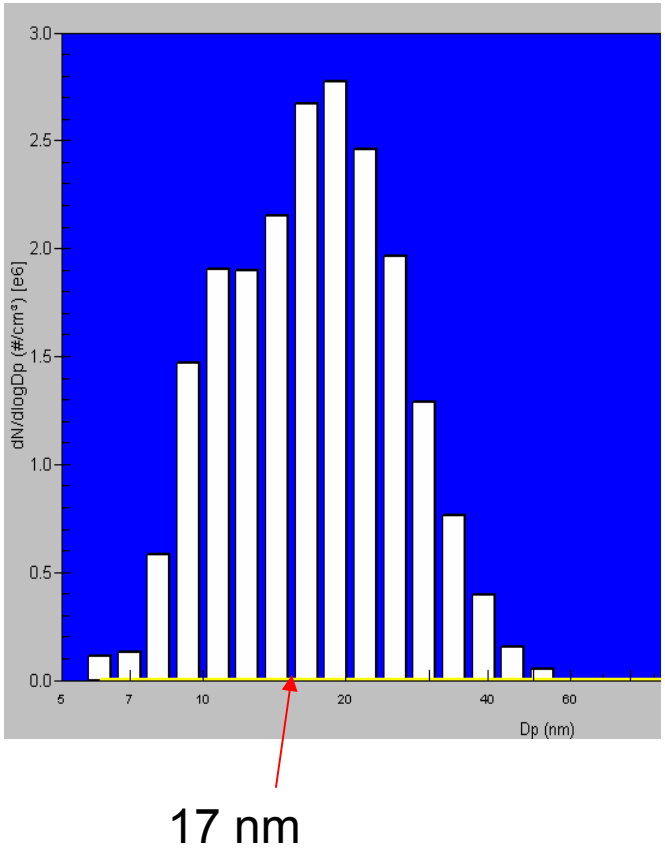
# Exposure Atmosphere




17 nm

- Median diameter: 17 nm
- Particle Mass: 300 µg/$m^3$
- Particle Count: $10^6$ p/cc
- Surface Area: 25 $nm^2$/cc
- Vapor HC: 0.6 ppm
- CO: 0.3 ppm
- NOx: < 40 ppb
- Additional analyses underway

Calculated dose, assuming 50 % deposition, = 2 µg/day

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# Measurements of Response

Mice exposed to clean air or oil

- Change in inflammatory cells in lung
- Change in biochemical indicators of injury, inflammation or chemical stress in lung or serum
- Presence of particles or lung tissue damage assessed by light microscopy
- Change in systemic immune response

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# Does exposure increase response to a known irritant?

- Separate group of mice exposed (on day 4) by inhalation to ~5 µg inhaled dose of bacterial cell walls to induce inflammation
  - Similar to “bronchitis”
- Measured same endpoints as non-LPS

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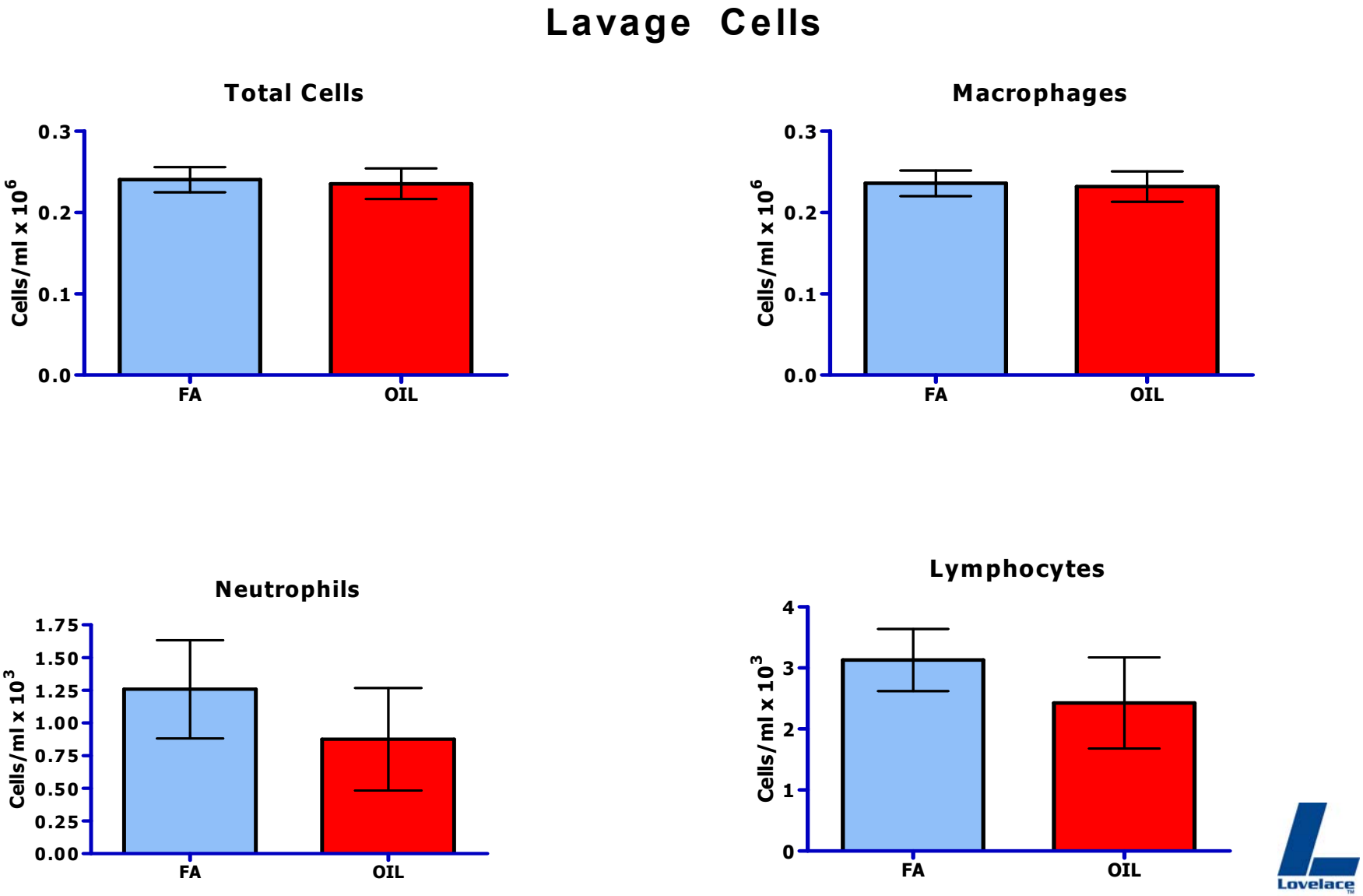
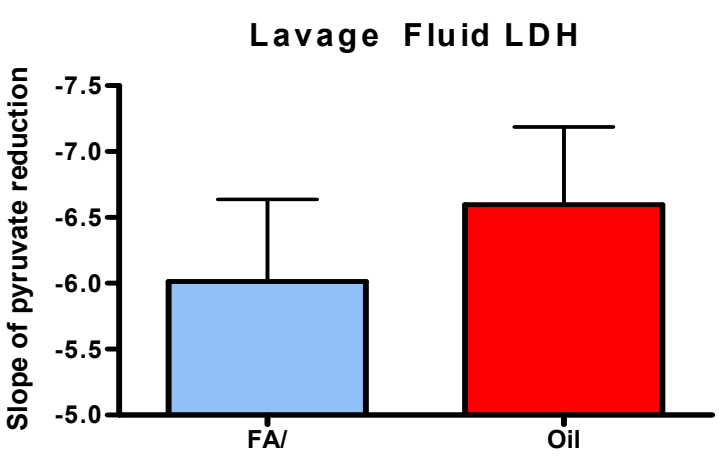
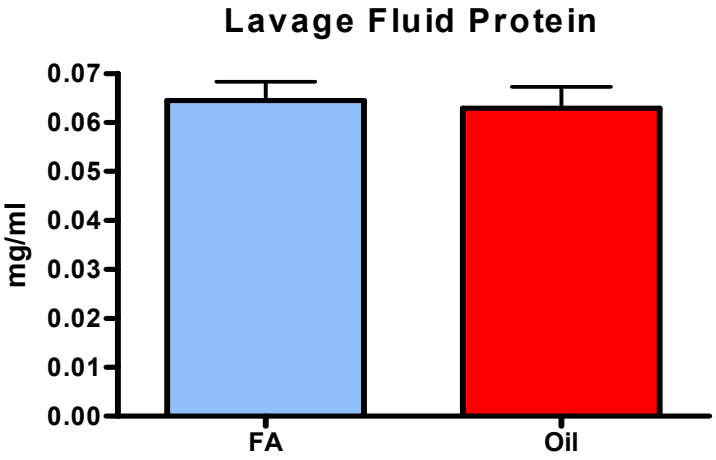
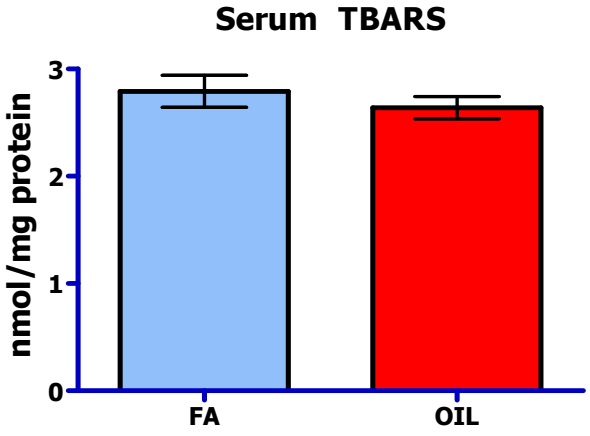
# No increase in inflammatory cells

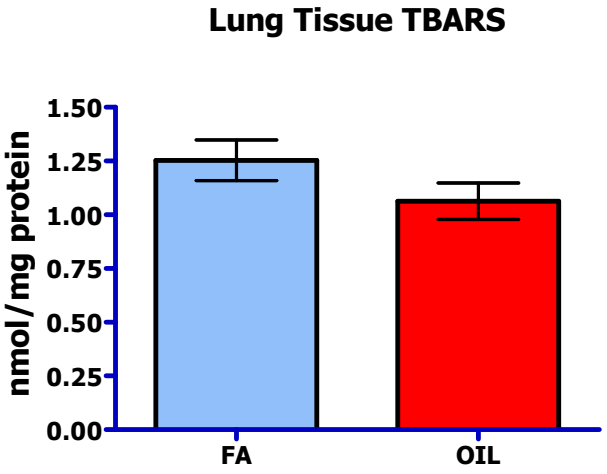


# Most Biochemical Indicators Did Not Increase with Exposure




Also did not see increase in inflammatory cytokines

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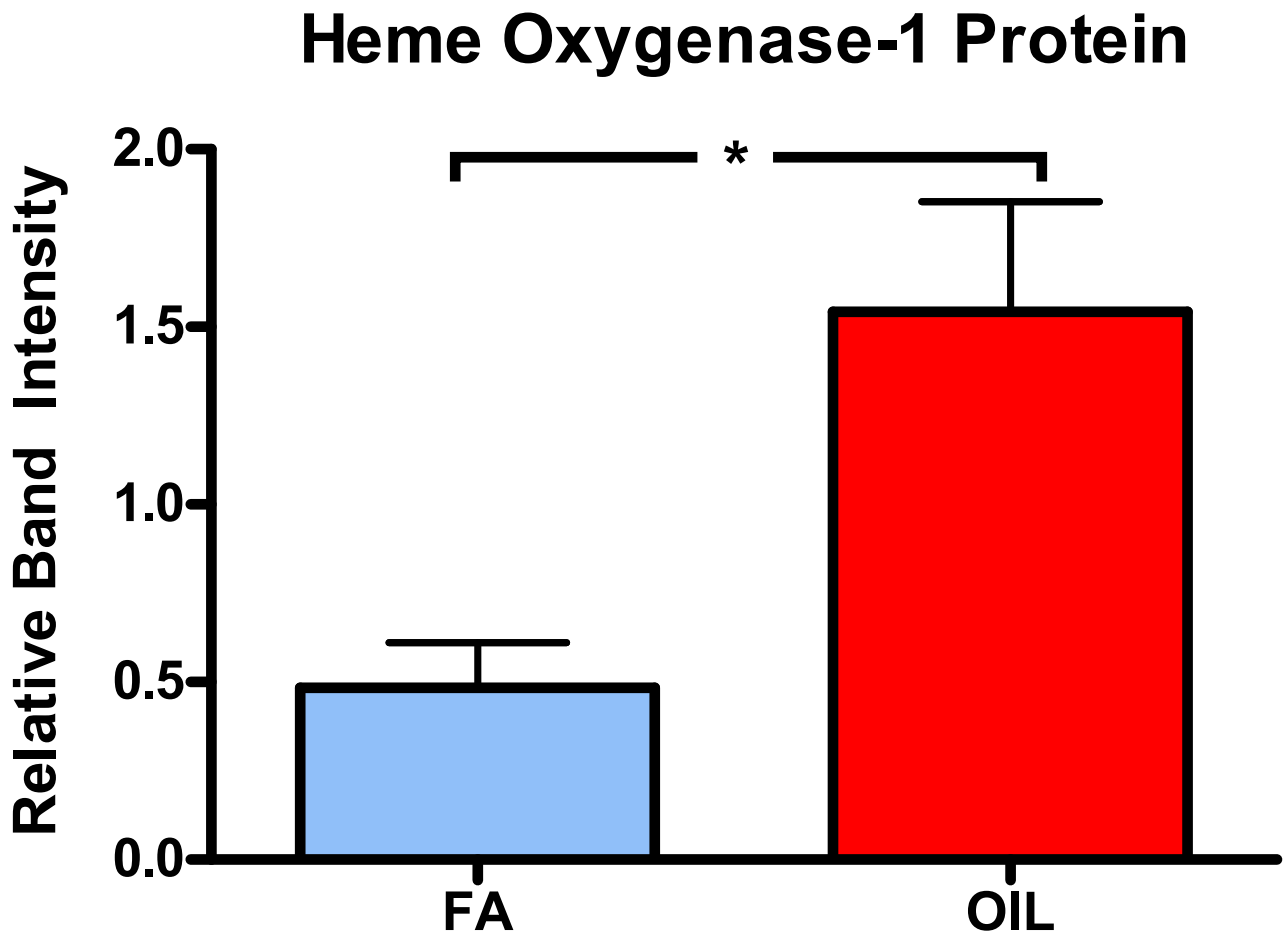
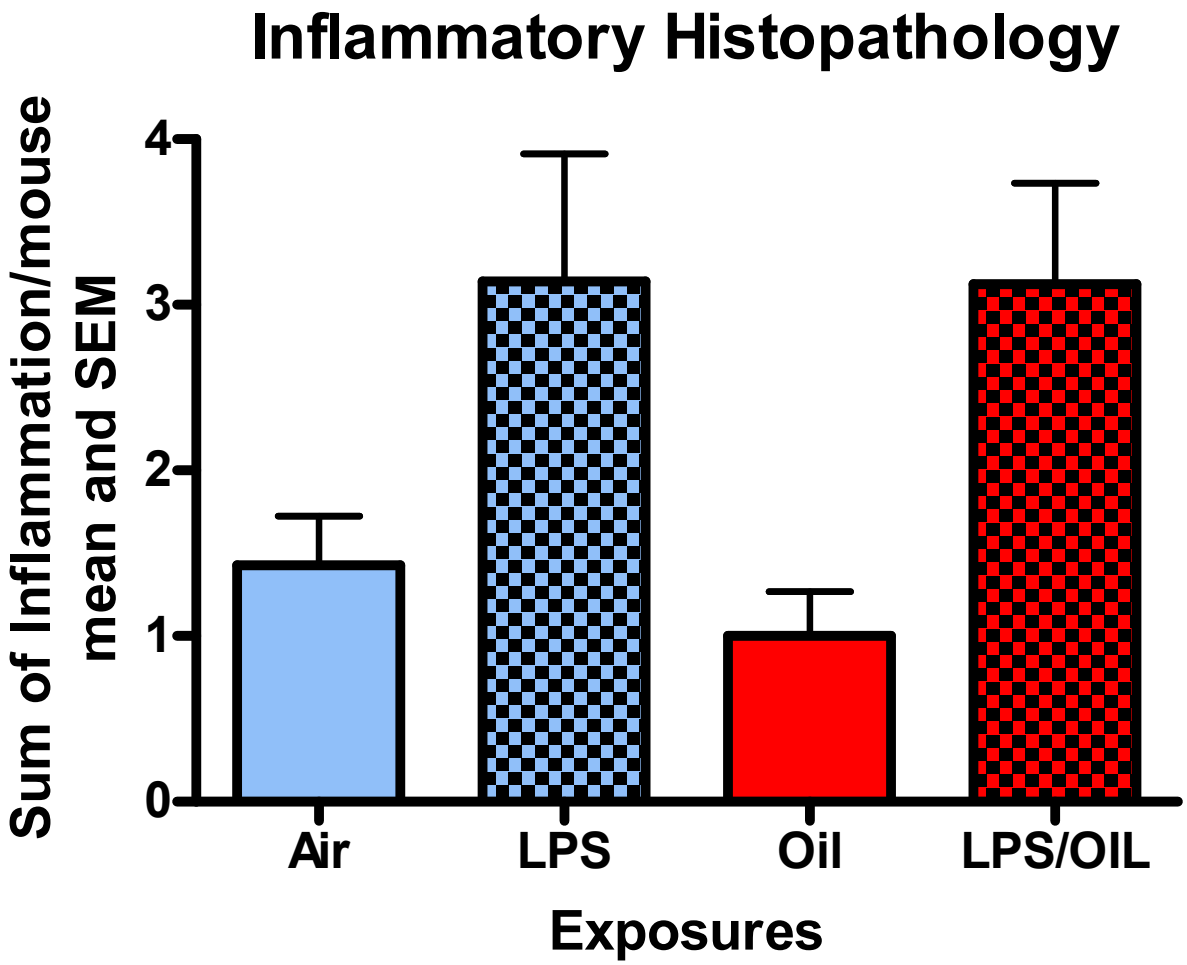
# A Sensitive Indicator of Oxidant Stress *DID* Increase

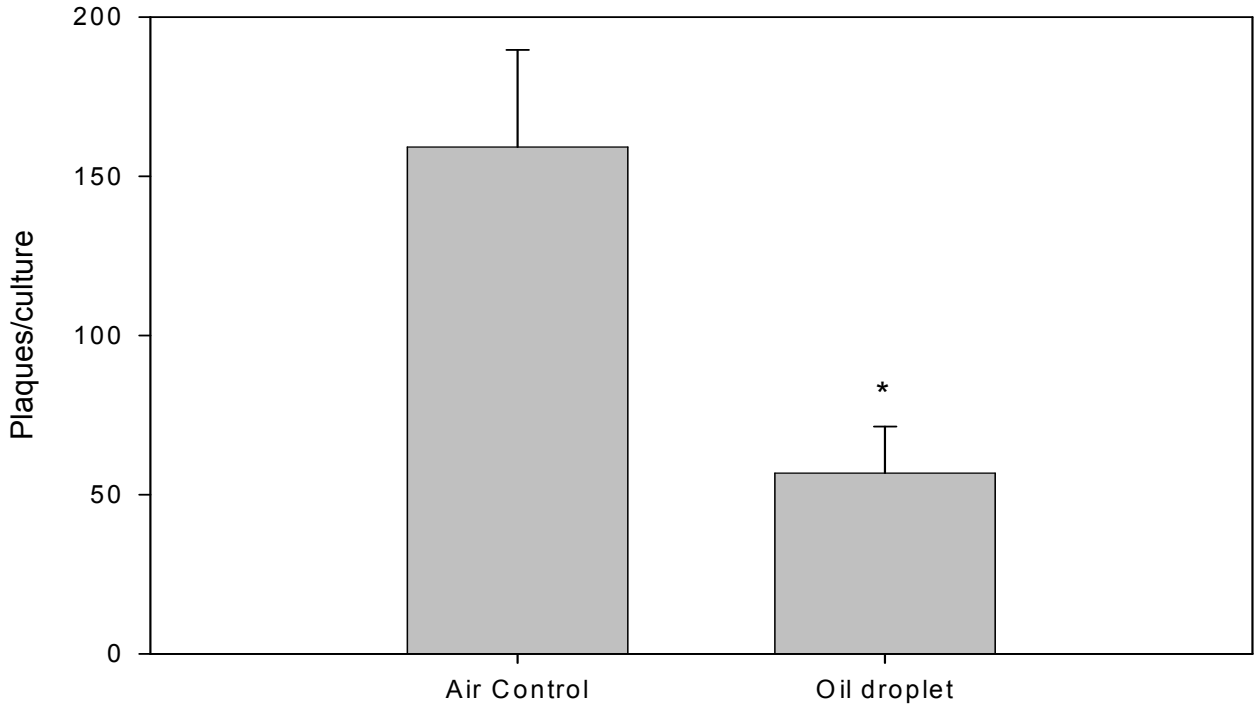


# LPS induced injury/inflammation not exacerbated by nanocondensates




LPS/OIL significantly greater than from FA/OIL

# Immune Response Decreased After Nanocondensate Exposure




* statistically significant difference with air control (P < 0.05)
n=7 mice/group

# Summary and Future Directions

- Inhaled nanocondensates showed very limited response for pathology, inflammatory cells, and biochemical indicators.
- While oil may have driven response to instilled material in previous studies with rats, it appears to be only mildly toxic at lower and inhaled doses in mice
- Only most sensitive indicators (oxidant stress/systemic immunity) showed physiological response to inhaled nanocondensates
  - These results to be confirmed and extended to no-effects levels
  - Results to also be compared with new oil, oil obtained from gasoline engines and nanosulfate for comparison.

IS NANOTOX = NANOHYPE??

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