

*Transfer of nanoplastics from the  
maternal to the fetal compartment*

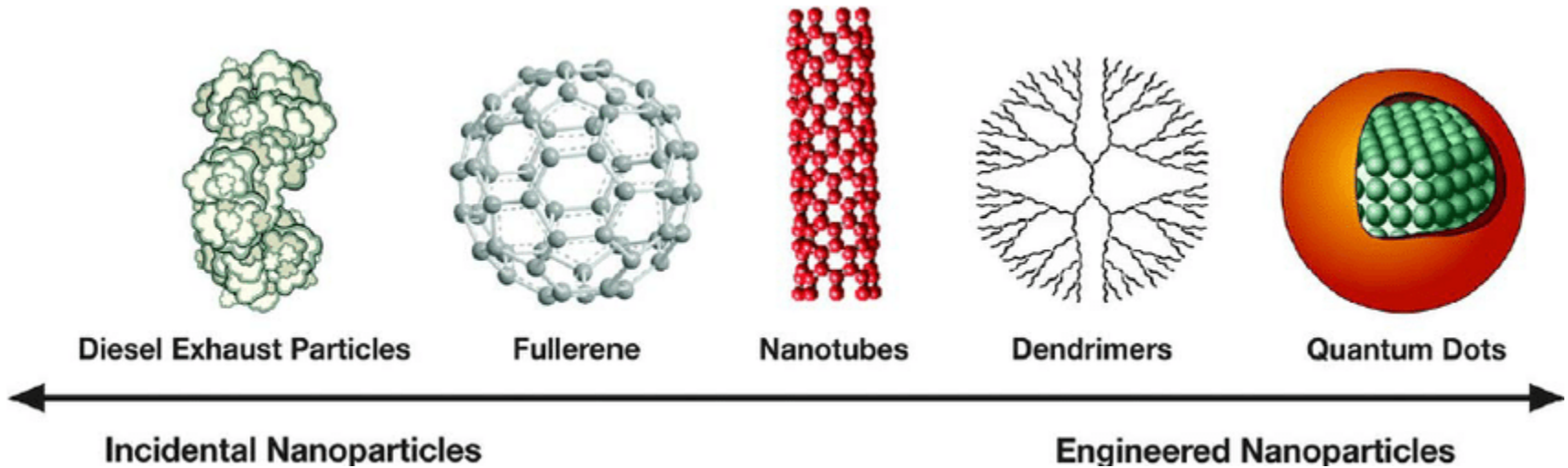
Phoebe Stapleton

Toxicology Panel

Impacts of Microplastics in the Urban Environment

March 28, 2019

# Engineered Nanomaterials



- Homogeneous composite of low-solubility and low-toxicity surrogate material.
- However, previously identified as “ultrafine” size, studies demonstrated higher inflammatory, reactive stress, and toxicity potential than larger counterparts. <sup>1,2</sup>

Larson, Biology of Reproduction, 2014

<sup>1</sup>. Stone, IEEE Trans Nanobioscience, 2007

<sup>2</sup>. Nurkiewicz, Part Fibre Toxicol, 2008

# Fetal Impact to Maternal ENM Exposure

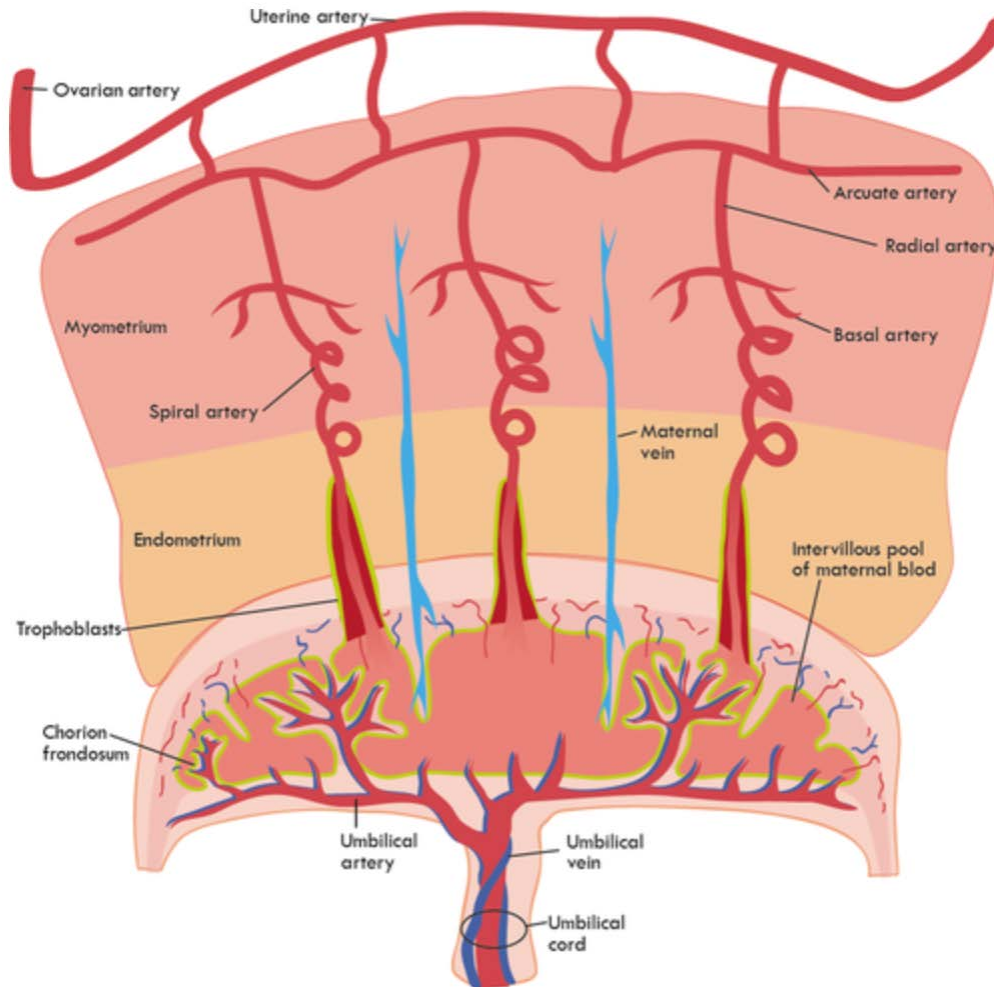
Treatment	Number of Reabsorption Sites
Naïve	0.58 ± 0.23
Air 4	0.20 ± 0.20
Air 12	0.00 ± 0.00
Air 17	0.00 ± 0.00
ENM 4	1.50 ± 0.76 (p=0.15)
ENM 12	1.38 ± 0.18*
ENM 17	0.71 ± 0.29*

Values are shown as mean ± SEM..\* indicates  $p \leq 0.05$  when compared to Air at each respective gestational day

Do nanoparticles translocate across  
the placenta?

20 nm Rhodamine-Polystyrene

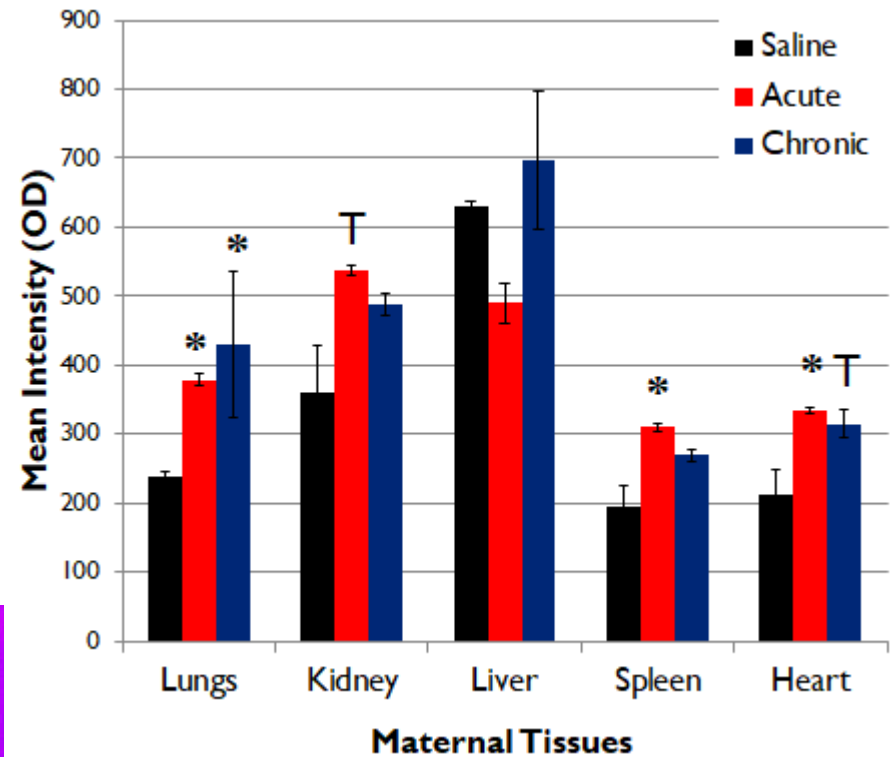
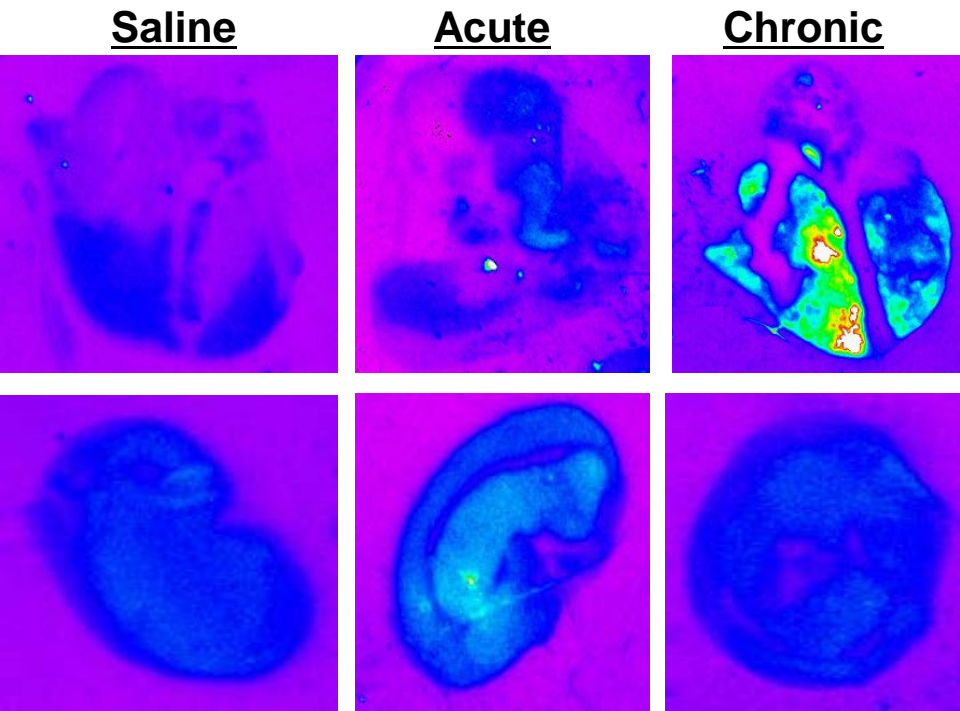
# Utero-placental Vasculature



# Maternal ENM

## Translocation – 24 hours

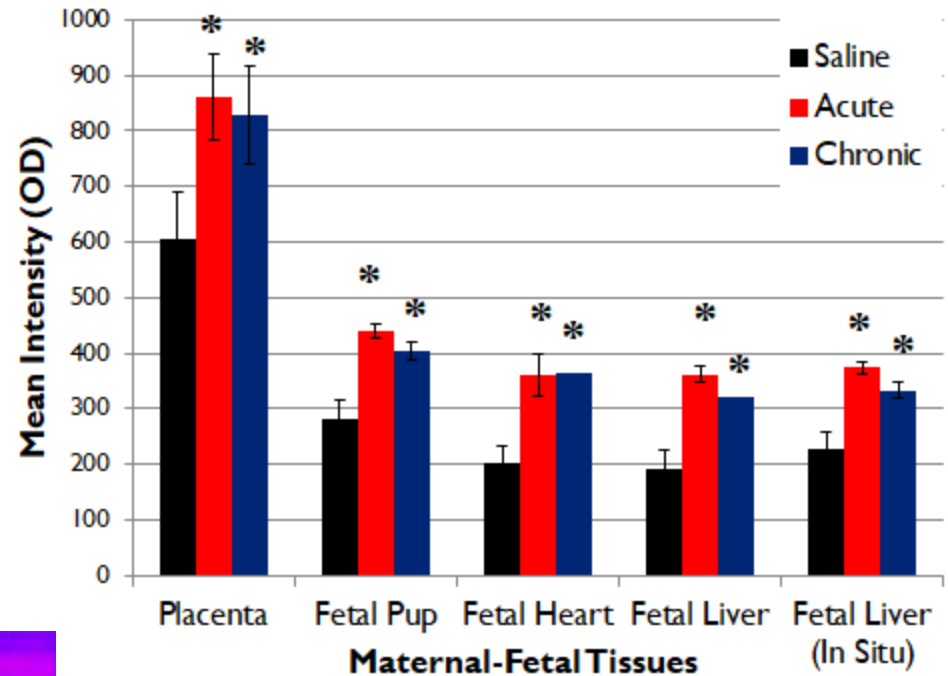
### 20 nm Rhodamine-Polystyrene



FX Pro –  
Fluorescent Imaging

# Fetal ENM

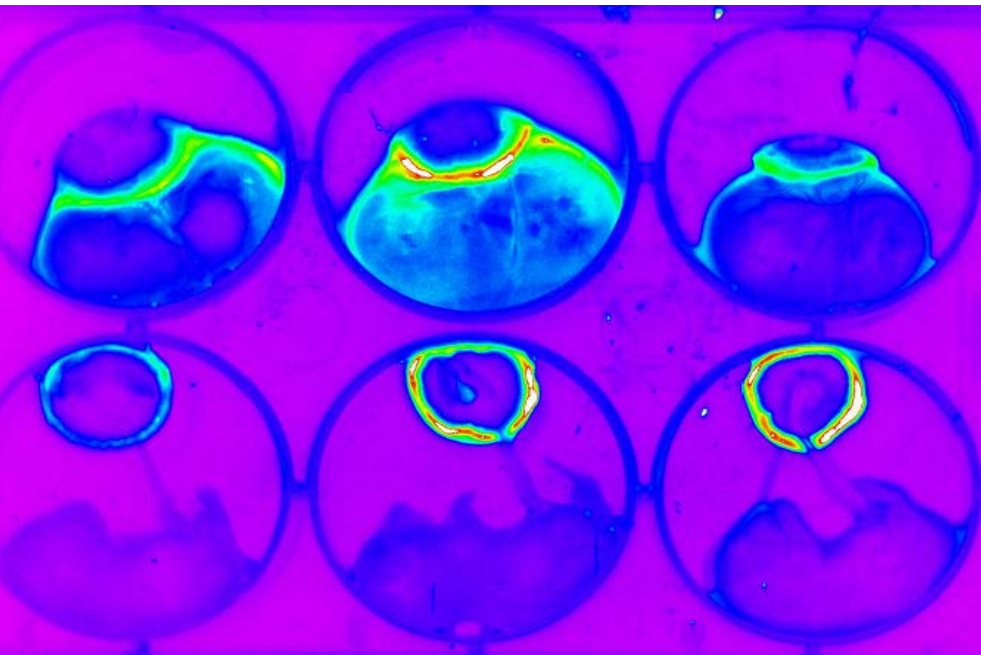
Translocation – 24 hours  
20 nm Rhodamine-Polystyrene



Saline

Acute

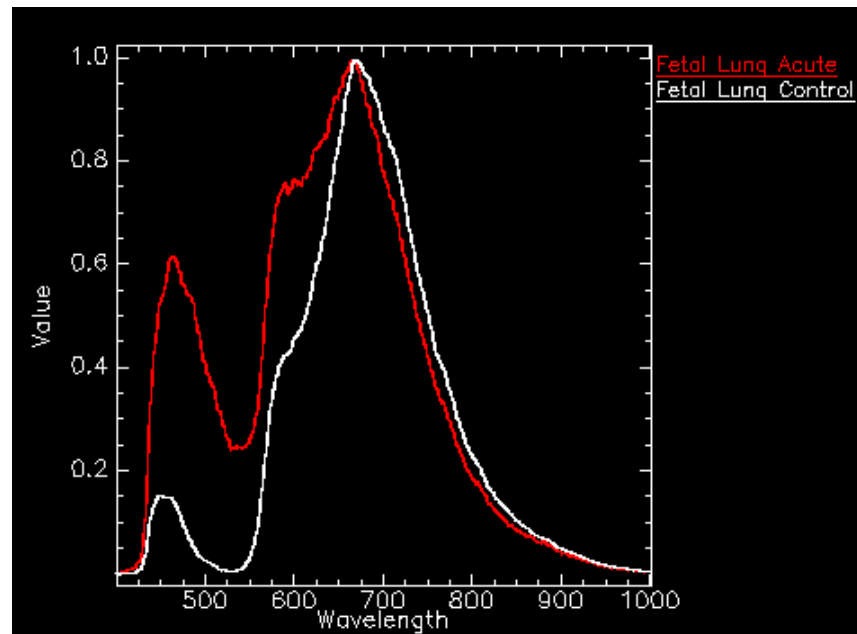
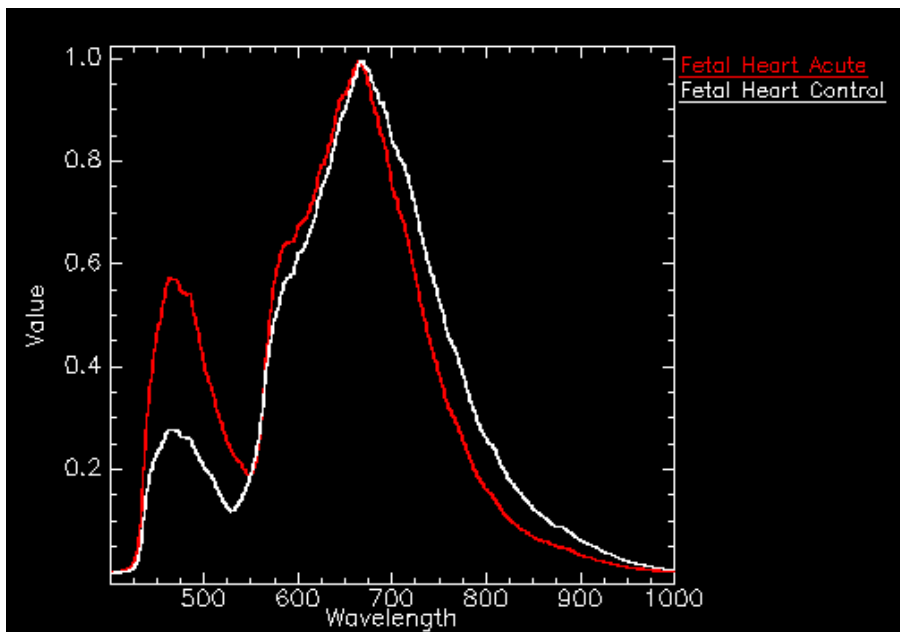
Chronic



FX Pro –  
Fluorescent Imaging

# Fetal Deposition – Acute Exposure

## Dark-field Microscopy and Hyperspectral Imaging (CytoViva)

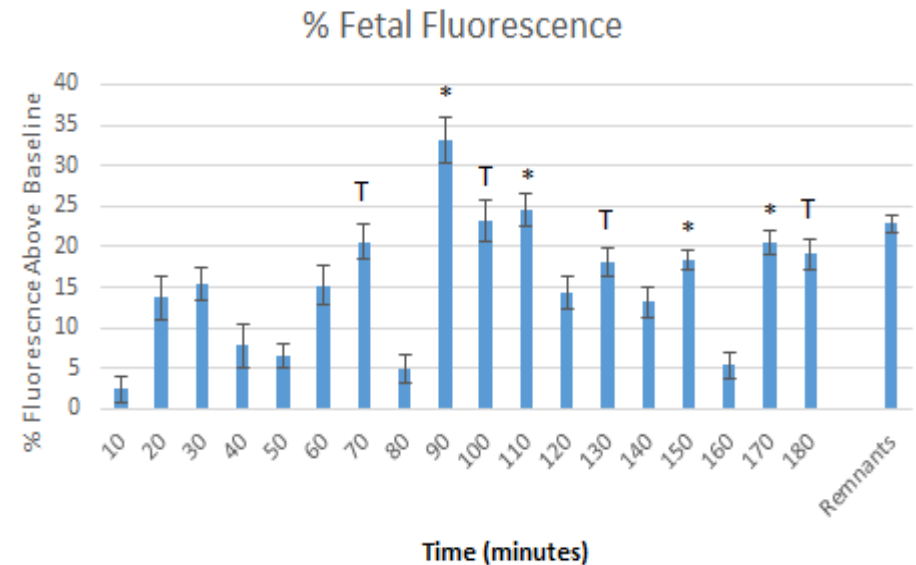
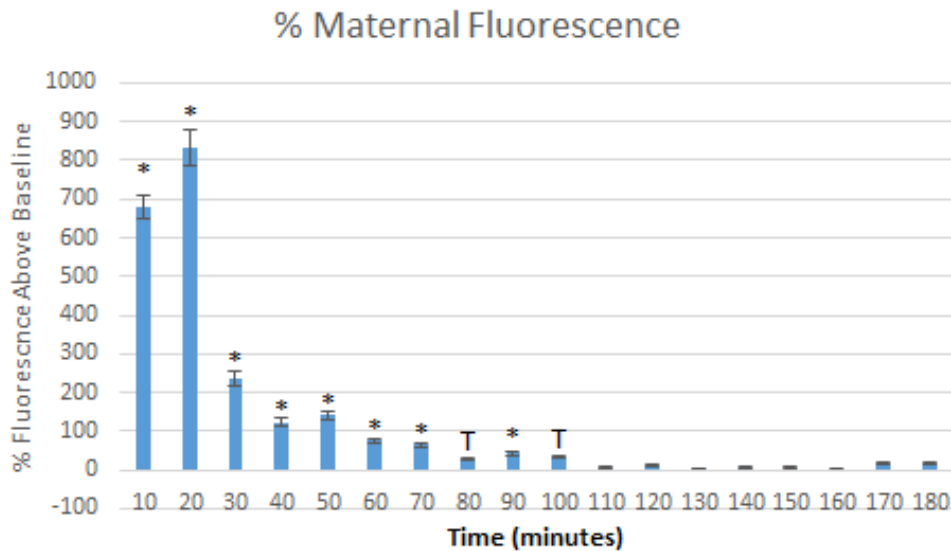




If so, how quickly can they cross?



# Placental ENM Translocation



D'Errico, JOVE, accepted and In Press

D'Errico, The Toxicologist, 2018;

\* $p < 0.05$ ; T= $p < 0.10$

# Nanoplastic Translocation to the Fetal Compartment

## Conclusions

- Based on our preliminary work:
  - ENM translocate to the fetal compartment
  - Deposit in systemic fetal tissues
  - Can occur within an hour of injection

## Future Directions

- Quantify Au-ENM transfer using ICPMS.
- Reassess PS-R transfer to confirm particles remain impregnated with R and there is no disassociation.
- Utilize the placental perfusion technique –
  - vascular studies
  - nutrient transfer
  - toxicant passage

# Acknowledgements

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Questions?