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Category: Postdoc
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Title: Differential effects of developmental Fe or Fe+S aerosol exposure on neonatal neurochemistry and motor impulsivity in adulthood
Abstract: Air pollution (AP) is a growing threat to human health. Concomitant with its cardiopulmonary toxicity, AP exposure can adversely affect neurodevelopment. Air pollution is a complex mixture of gases and particulate matter, including trace elements, which may differentially contribute to its neurodevelopmental impacts. Epidemiological data suggest that iron (Fe) and sulfur dioxide (SO2) concentrations in air pollution may drive neurobehavioral deficits associated with exposure. Similarly, data from our lab indicates that brains of neonatal mice exposed to concentrated ambient ultrafine AP showed significant CNS translocation of Fe and sulfur, which were two of the most abundant elements detected in the ultrafine aerosol. To determine the impact of these constituents specifically, male and female neonatal mice were either exposed to filtered air or an aerosol mixture of ultrafine Fe particles and sulfur dioxide (SO2) or ultrafine Fe alone (n = 12/exposure/sex). Inhalation exposures occurred from postnatal day (PND) 4-7 and 10-13 for 4 hr/day. Across all exposure days, particle diameter averaged 12.43 nanometers and Fe particle concentration averaged 2.16x105 particles/cm3 (~1 μg/m3) with a SO2 concentration of approximately 498 ppb. The day following exposure (PND 14), tissue from striatum, a brain region implicated in impulsivity, was harvested from a subset of mice from each exposure for neurotransmitter quantification via mass spectrometry. Another subset of mice was tested in adulthood for motor impulsivity using a task requiring precisely timed lever press responses to earn food reward. Neonatal Fe+S exposure produced robust, sex-specific neurochemical disruption at PD14 via alterations in dopamine, serotonin, GABA, and glutamate systems, but only produced transient male-specific increases in impulsive responding in adulthood. In contrast, Fe exposure alone did not impact neurochemistry at PD14, but produced more consistent male-specific increases in impulsivity in adulthood. Thus, elemental constituents of air pollution, including Fe and S, can produce detectable neurobiological disruption early in life that may contribute to deficits in impulse-control later in life.