Brain and Behavioral Effects of Early Exposure to a Neurotoxicant

This presentation addresses the impact of prenatal exposure to a common neurotoxicant on brain structure and neuropsychological function in an inner-city cohort of minority children. The toxic chemical, an organophosphate insecticide (chlorpyrifos), has been banned for indoor residential use in the U.S. since 2001, but continues to have widespread application for agricultural purposes. The identification of neurotoxic effects in animal studies at exposure levels well below the threshold for systemic toxicity caused by cholinesterase inhibition in the brain prompted a prospective cohort study to investigate possible long-term human effects at levels of exposure that are commonly found in many areas of the country. Possible noncholinergic mechanisms involve disruption of neural cell development and neurotransmitter systems, including the formation and activity of synapses in different brain regions. This presentation examines the evidence for long-term effects of prenatal chlorpyrifos exposure on neuropsychological profiles and brain morphology as measured by MRI. Highly exposed children show a unique neuropsychological profile, with significant deficits in auditory attention and fine motor performance, but no deficits on more complex visual attention and inhibitory control tasks. These findings are consistent with abnormalities in morphological measures of the cortical surface, including the posterior temporal region, sub-serving attention and receptive language. Results suggest that prenatal pesticide exposure, at relatively modest doses common in agricultural regions of the U.S., results in a signature pattern of neuropsychological deficits, accompanied by disturbances in brain morphology by MRI, persisting into the early school years.