Science AAAS

Dr. Brian Moench

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THE POLLUTED BRAIN

Evidence builds that dirty air causes Alzheimer's, dementia

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"Pollution attacks the human brain"

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Evidence builds that dirty air causes Alzheimer's, dementia

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"Shrunken and atrophied neurites"

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"Smaller brain volume"

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"Smaller brain volume"

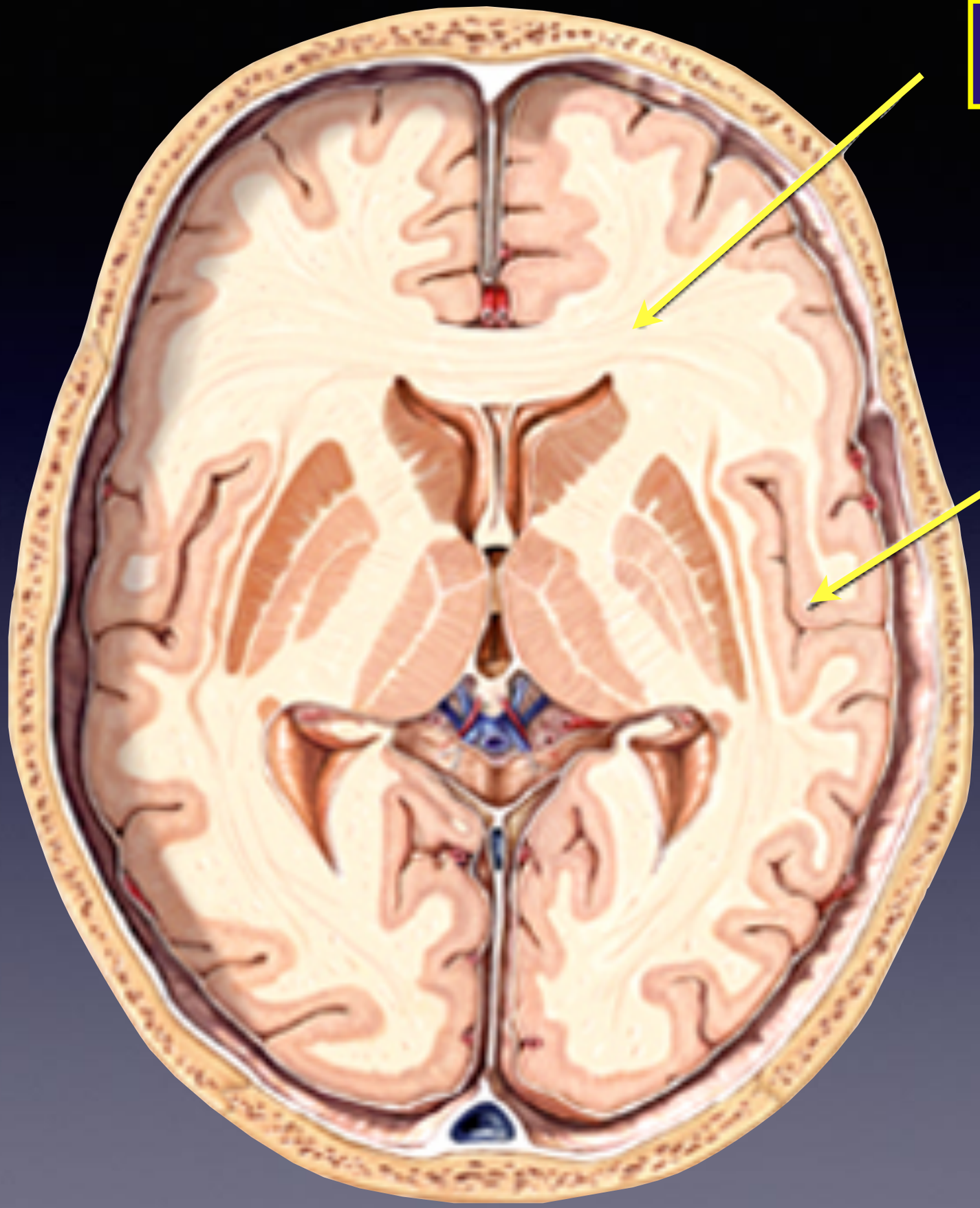
20% of Alzheimer's Disease

Evidence builds that dirty air causes Alzheimer's, dementia

Los Angeles Times
Science Now
Discoveries from the world of science and medicine

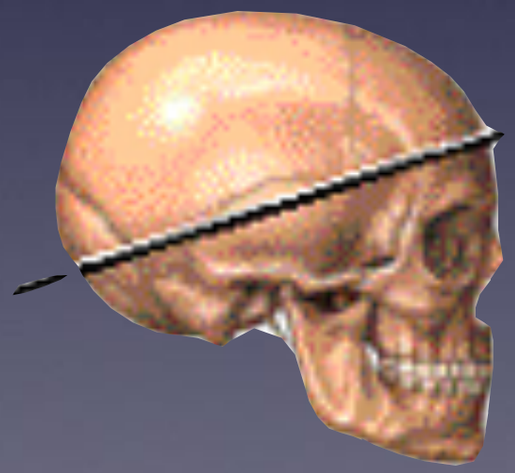
Air pollution takes a double toll on babies' brains

Powerful dose-response relationship between prenatal PAH exposure and loss of white matter on the left side of the child's brain involving almost the entire surface



White Matter

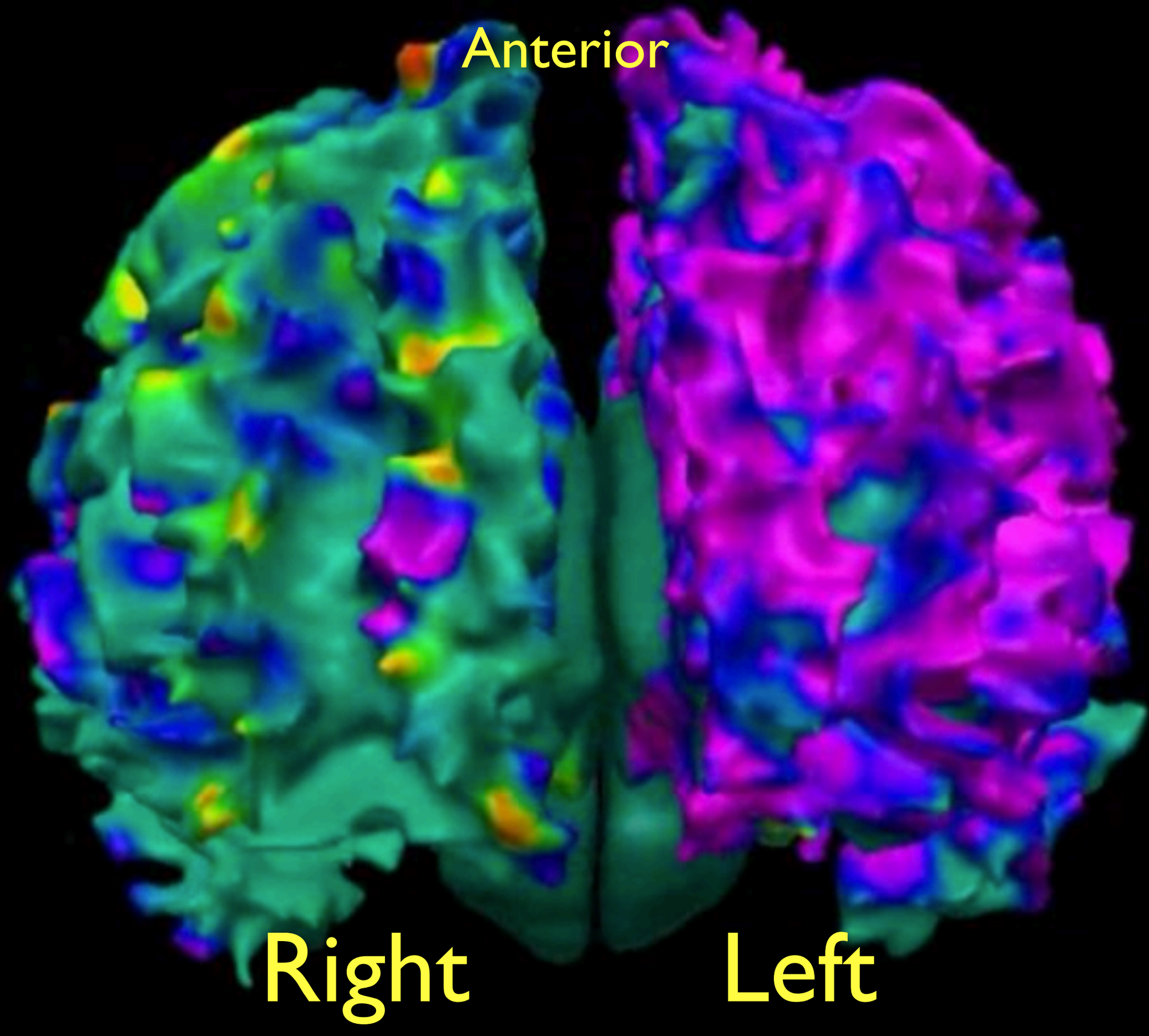
Gray Matter



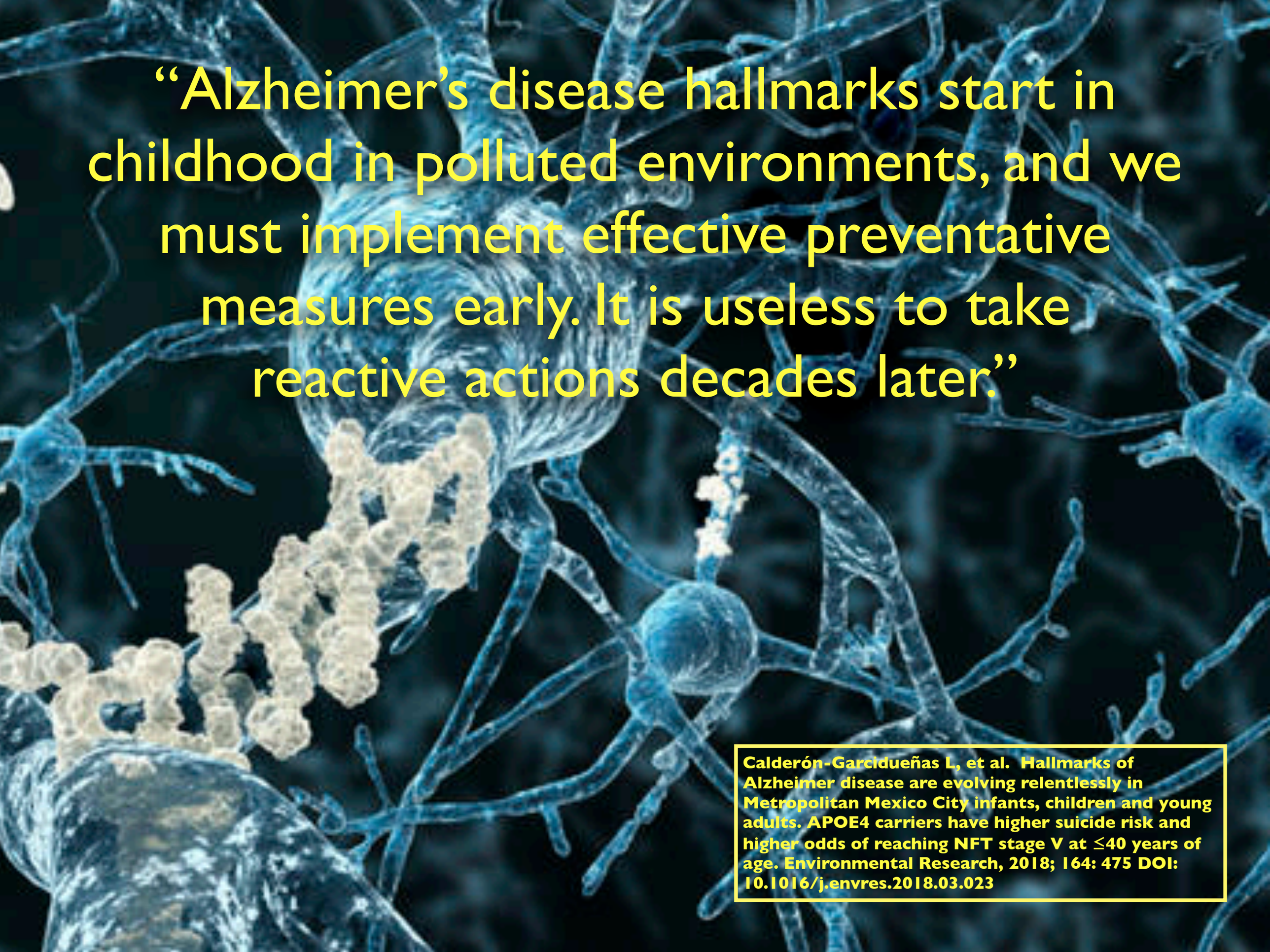
Peterson B, et al. Effects of Prenatal Exposure to Air Pollutants (Polycyclic Aromatic Hydrocarbons) on the Development of Brain White Matter, Cognition, and Behavior in Later Childhood. JAMA Psychiatry. Published online March 25, 2015. doi:10.1001/jamapsychiatry.2015.57

PAH exposure =
loss of white matter =
loss of intelligence and poor behavior


No safe level of PAH exposure


Anterior
Right
Left

Calderón-Garcidueñas L, et al. Hallmarks of Alzheimer disease are evolving relentlessly in Metropolitan Mexico City infants, children and young adults. APOE4 carriers have higher suicide risk and higher odds of reaching NFT stage V at ≤40 years of age. Environmental Research, 2018; 164: 475 DOI: 10.1016/j.envres.2018.03.023



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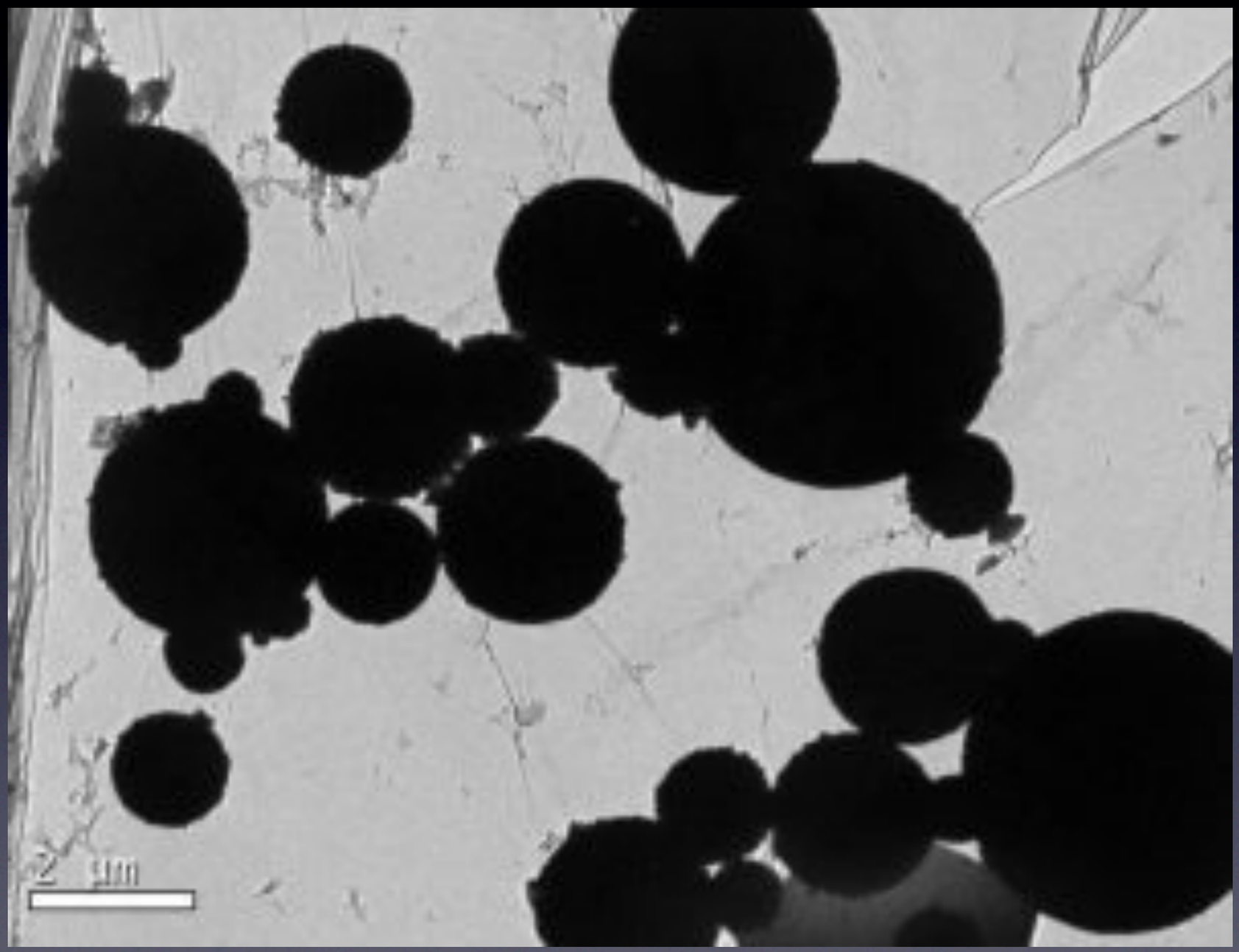
Pollution particles end up in the brain via two different routes



Maher, B, et al. Magnetite pollution nanoparticles in the human brain. PNAS 2016 ; published ahead of print September 6, 2016, doi:10.1073/pnas.1605941113

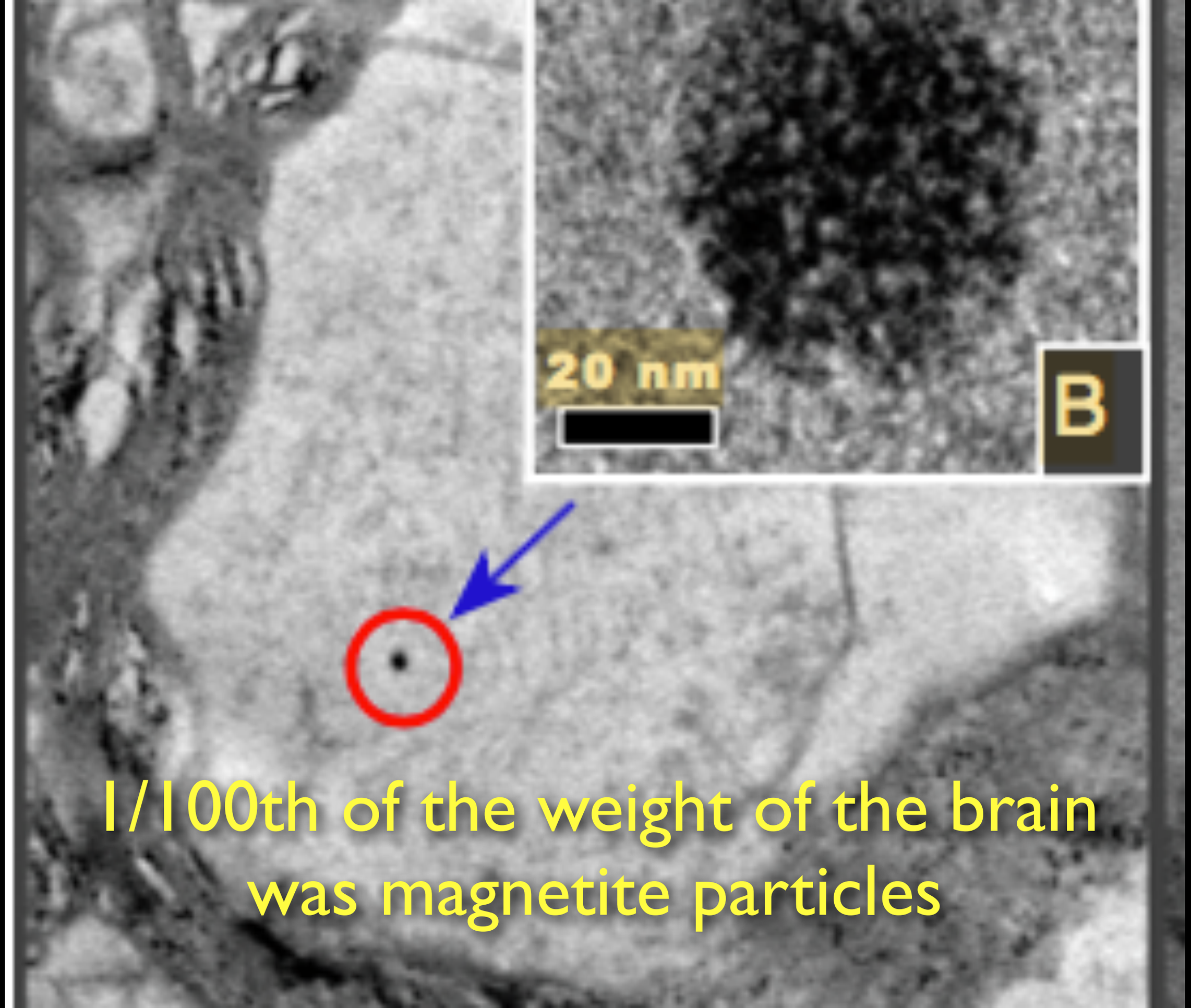
20 nm

B

20 nm

B

Millions of particles per gram
of brain tissue



1/100th of the weight of the brain was magnetite particles

Pollution inhaled on the way to school affects a child's ability to learn on that same day once they get there.

Sunyer J, et al. Traffic-related Air Pollution and Attention in Primary School Children: Short-term Association. Epidemiology: March 2017 - Volume 28 - Issue 2 - p 181â€“189. doi: 10.1097/EDE.0000000000000603

Air pollution inhaled walking to school impairs cognition

Alvarez-Pedrerol M, et al. Impact of commuting exposure to traffic-related air pollution on cognitive development in children walking to school. Environ Pollut. 2017 Dec;231(Pt 1): 837-844. doi: 10.1016/j.envpol.2017.08.075. Epub 2017 Sep 25.

Clark-Reyna SE, et al. Residential exposure to air toxics is linked to lower grade point averages among school children in El Paso, Texas, USA. Popul Environ. 2016 Mar;37(3): 319-340. Epub 2015 Jul 17.

Exposure to air toxics in the home associated with lower grade point averages

Natural gas appliances in the home was inversely associated with cognitive function and attention span at age four.

Morales, E., Julvez, J., Torrent, M., et al. Association of Early-life Exposure to Household Gas Appliances and Indoor Nitrogen Dioxide With Cognition and Attention Behavior in Preschoolers. American Journal of Epidemiology 2009 169(11): 1327-1336;