

Dr. Brian Moench

Utah Physicians for a Healthy Environment

THE POLLUTED BRAIN

Evidence builds that dirty air causes Alzheimer's, dementia



“Pollution attacks the human brain”

THE POLLUTED BRAIN

Evidence builds that dirty air causes Alzheimer’s, dementia



“Shrunken and atrophied neurites”

THE POLLUTED BRAIN

Evidence builds that dirty air causes Alzheimer’s, dementia



“Smaller brain volume”

THE POLLUTED BRAIN

Evidence builds that dirty air causes Alzheimer’s, dementia



“Smaller brain volume”

20% of Alzheimer's Disease

Evidence builds that dirty air causes Alzheimer's, dementia



Los Angeles Times

Science Now

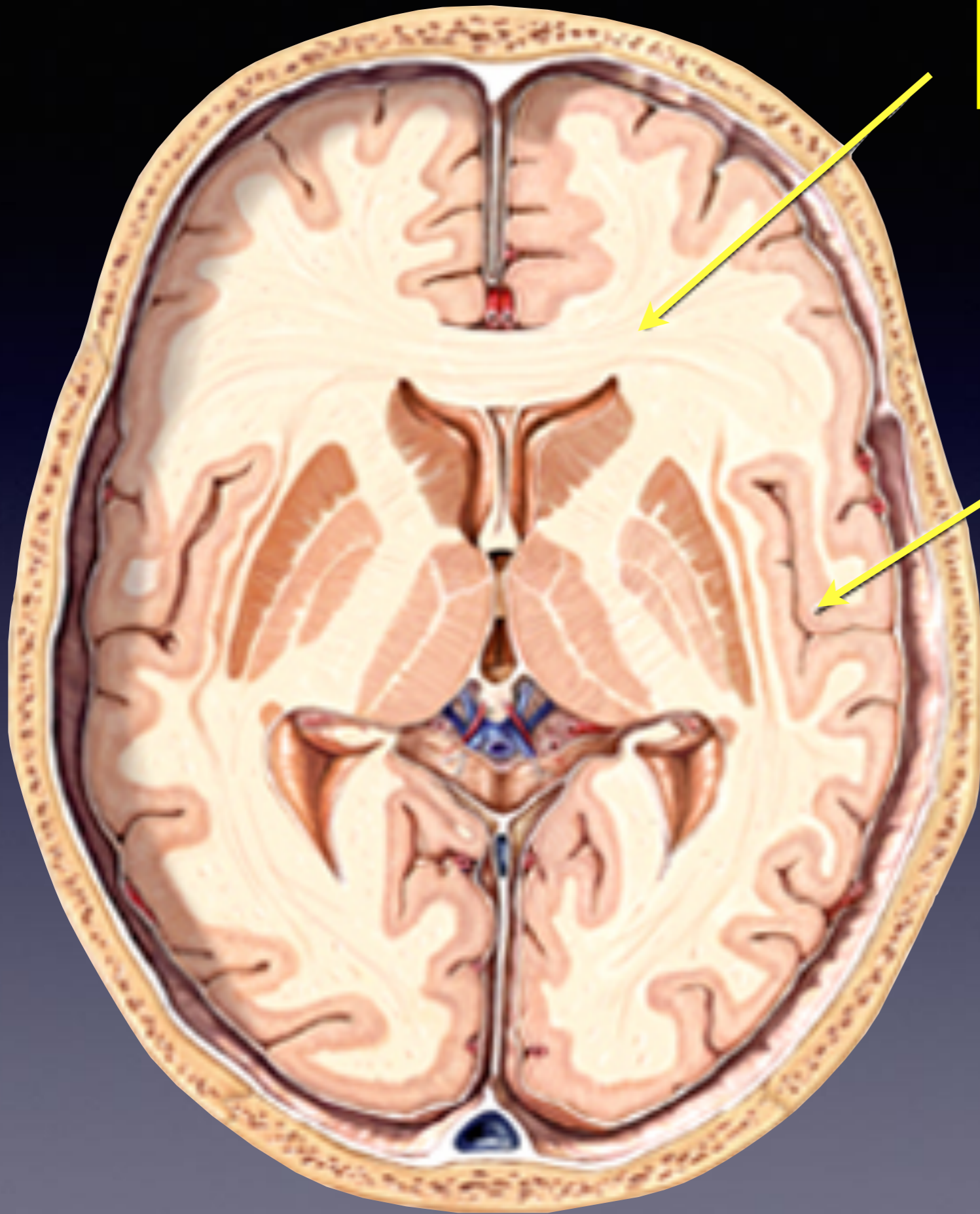
Discoveries from the world of science and medicine



Air pollution takes a double toll on babies' brains

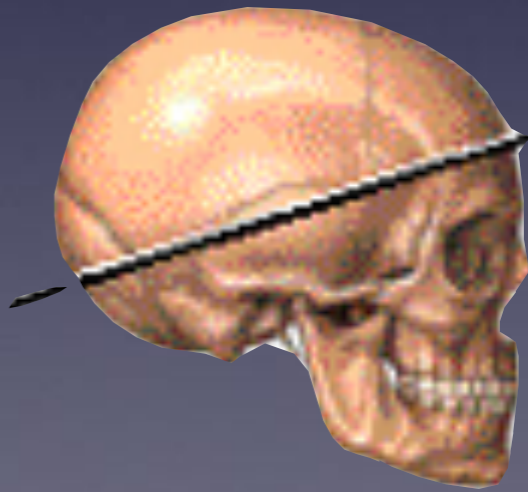


Powerful dose-response relationship between prenatal PAH exposure and loss of white matter on the left side of the child's brain involving almost the entire surface



White Matter

Gray Matter



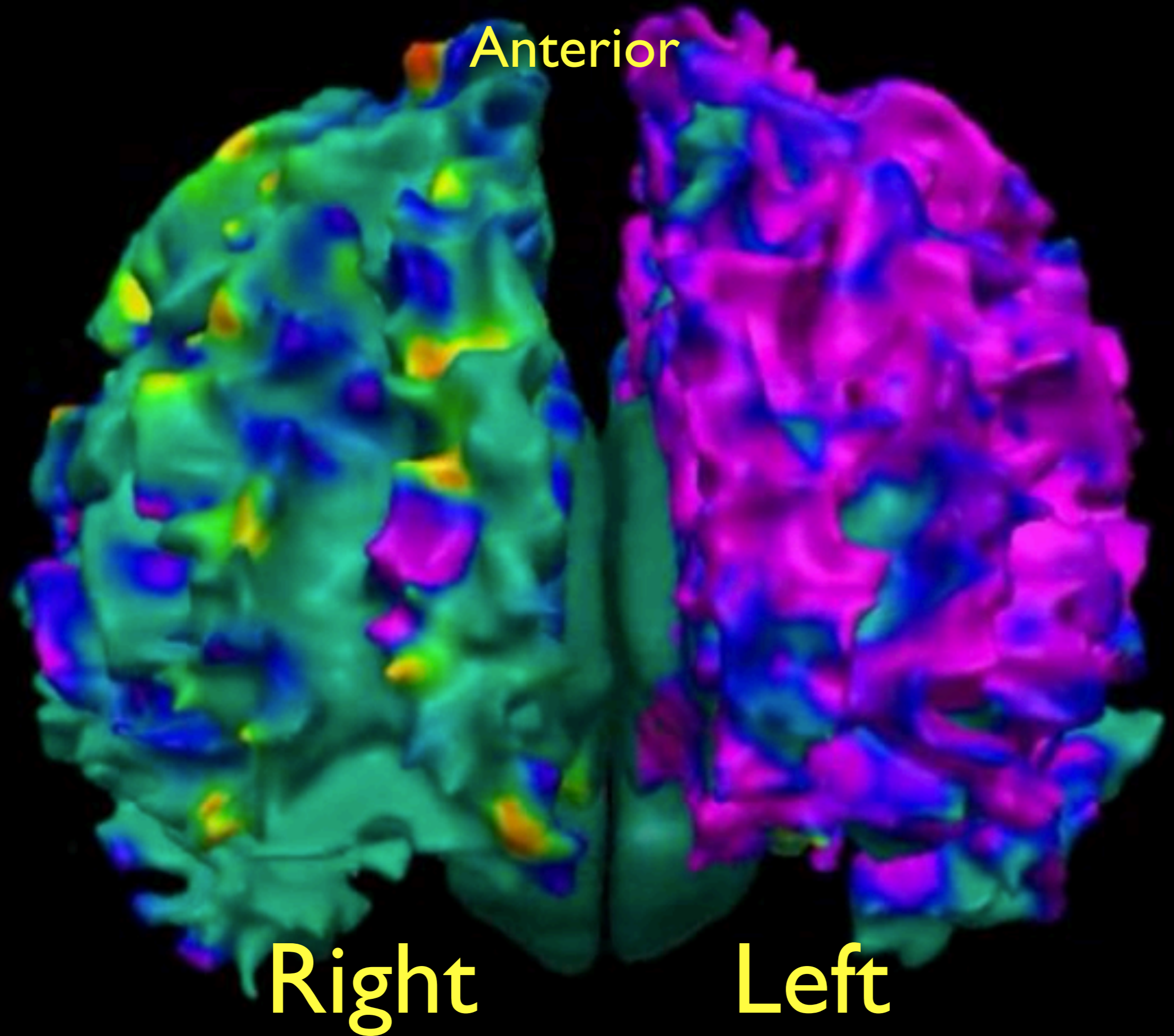
Peterson B, et al. Effects of Prenatal Exposure to Air Pollutants (Polycyclic Aromatic Hydrocarbons) on the Development of Brain White Matter, Cognition, and Behavior in Later Childhood. *JAMA Psychiatry*. Published online March 25, 2015. doi:10.1001/jamapsychiatry.2015.57

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




No safe level of PAH exposure

Anterior



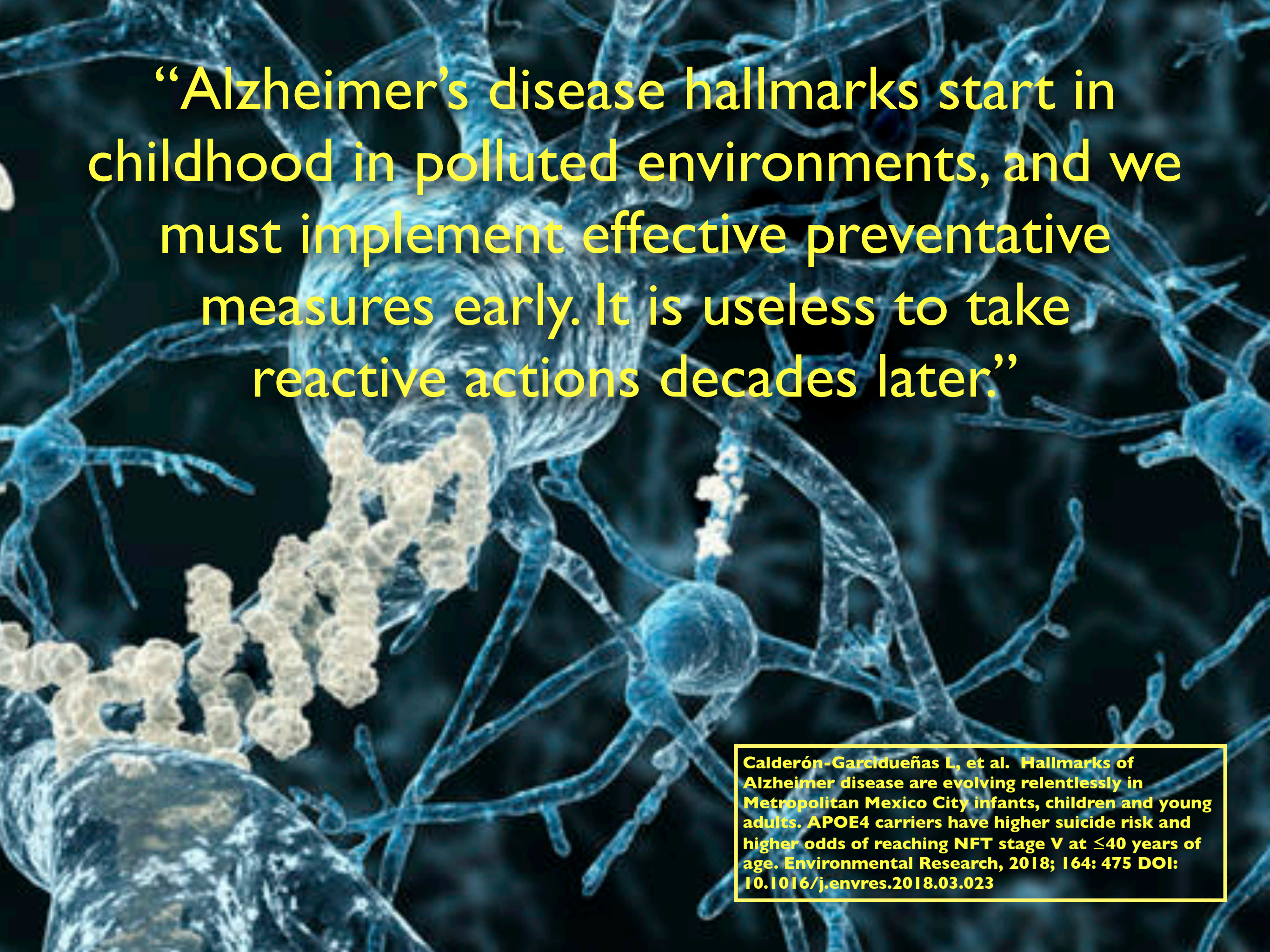
Right

Left

A microscopic image of neurons, likely from a mouse model of Alzheimer's disease. The neurons are stained in shades of blue and green, showing their complex branching structure. Several neurons have large, dense, yellowish-orange clusters of amyloid plaques attached to their cell bodies and extending along their processes. The background is dark, making the stained structures stand out.

Alzheimer proteins proportional
to the amount of air pollution,
found even in infants.

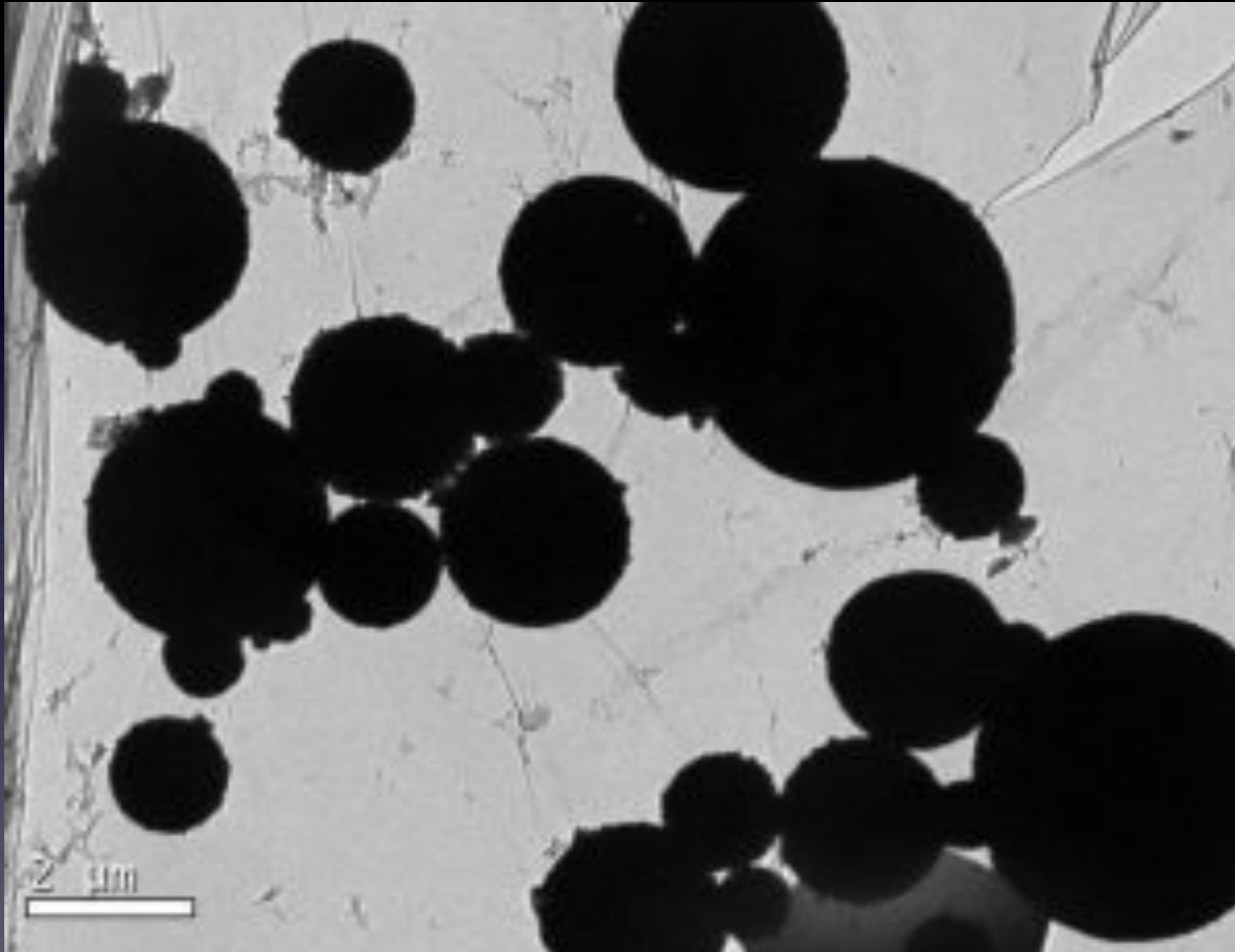
Calderón-Garcidueñas L, et al. Hallmarks of Alzheimer disease are evolving relentlessly in Metropolitan Mexico City infants, children and young adults. APOE4 carriers have higher suicide risk and higher odds of reaching NFT stage V at ≤ 40 years of age. Environmental Research, 2018; 164: 475 DOI: 10.1016/j.envres.2018.03.023

A microscopic image of neurons, showing cell bodies and branching processes. Some neurons have yellowish, clumpy deposits (amyloid plaques) on their processes. The background is dark blue.

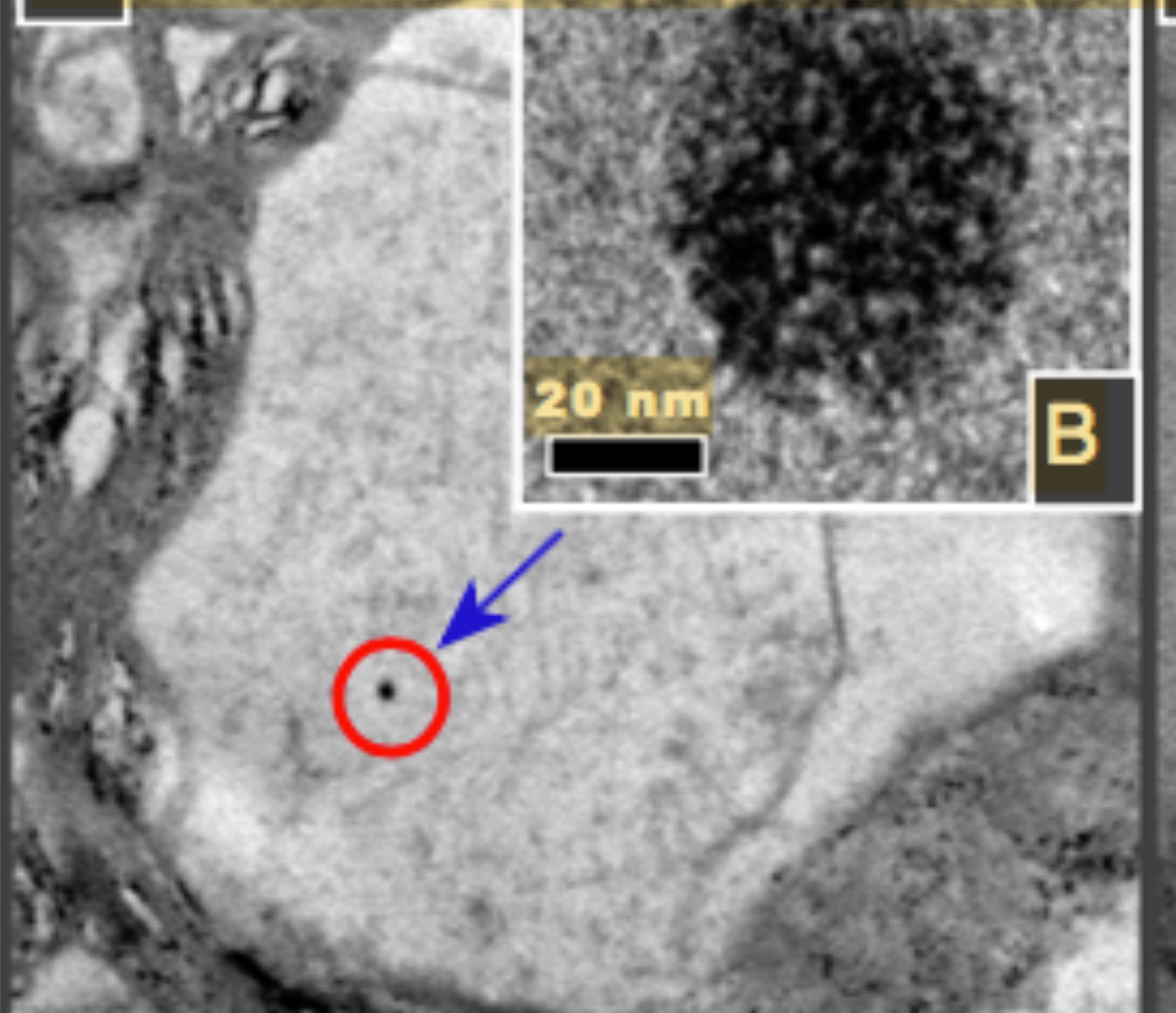
“Alzheimer’s disease hallmarks start in childhood in polluted environments, and we must implement effective preventative measures early. It is useless to take reactive actions decades later.”

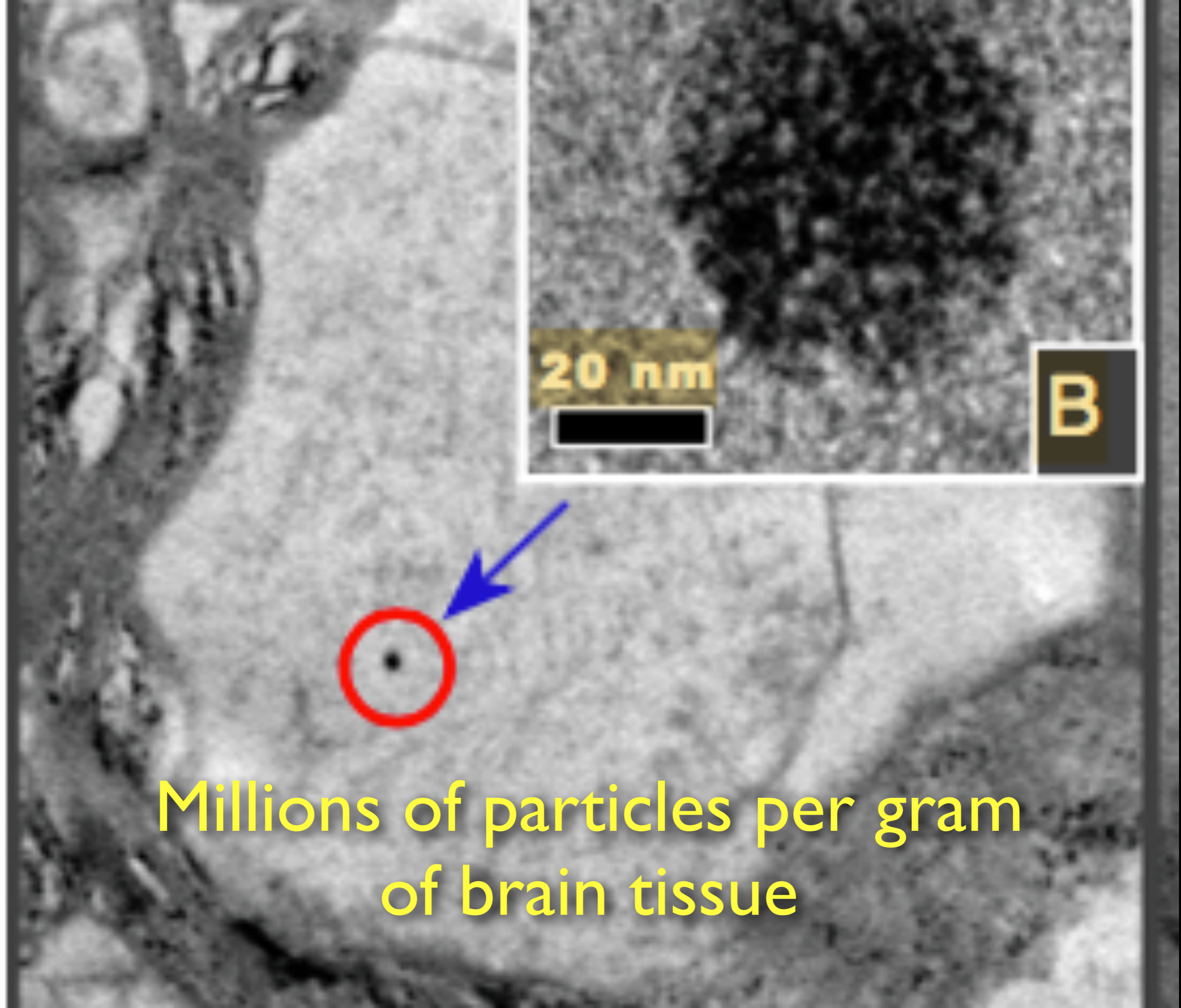
Calderón-Garcidueñas L, et al. Hallmarks of Alzheimer disease are evolving relentlessly in Metropolitan Mexico City infants, children and young adults. APOE4 carriers have higher suicide risk and higher odds of reaching NFT stage V at ≤ 40 years of age. Environmental Research, 2018; 164: 475 DOI: 10.1016/j.envres.2018.03.023

Pollution particles end up in the brain via two different routes

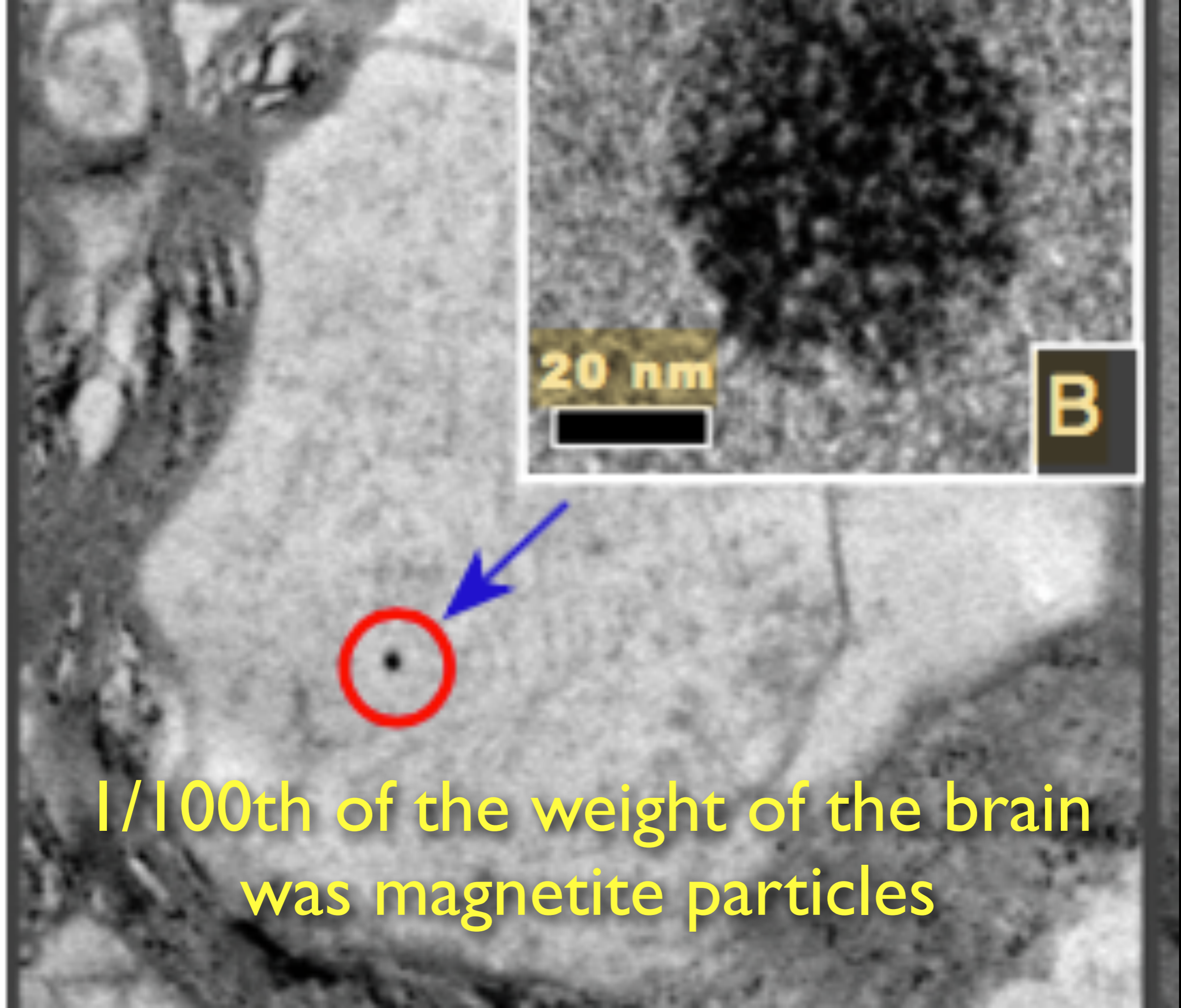


**Maher, B, et al. Magnetite pollution nanoparticles in the human brain. PNAS 2016 ;
published ahead of print September 6, 2016, doi:10.1073/pnas.1605941113**






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 181-189. 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;