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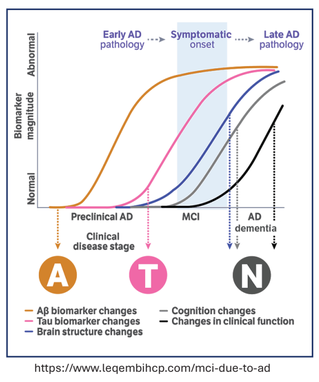
Decoding the Neuroexposome: An AI-Driven Framework for Mapping Environmental Drivers of Alzheimer's Disease

AI-driven synthesis of multi-omics and toxicity databases to prioritize neurotoxic chemical exposures.
Epidemiological cohort validation and blood epigenomics to map biological pathways to Alzheimer's risk.

Background



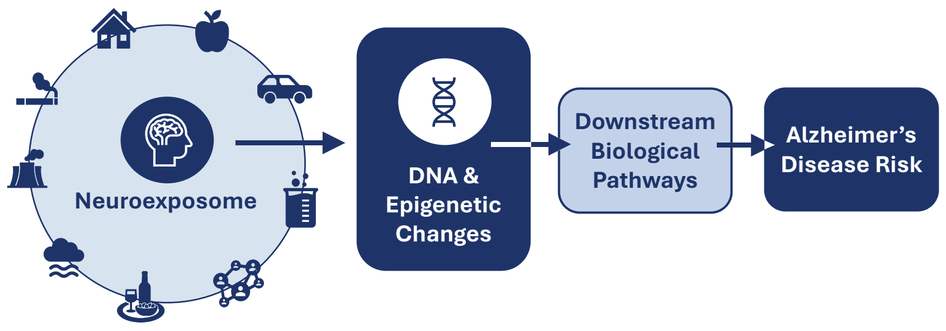
https://www.leqembihcp.com/mci-due-to-ad

Pathological brain changes associated with Alzheimer's disease begin **decades before symptoms appear**

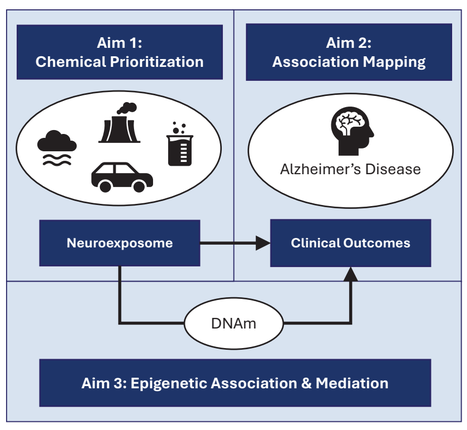
45% of risk factors for Alzheimer's disease, including **air pollutants and other environmental exposures,** are potentially **modifiable**

Exposome

"The Totality of Exposures"



People are exposed to **millions of chemicals**
— how do we identify **which ones actually matter**?



How can we use AI/machine learning to prioritize chemicals for study?

Are prioritized chemicals associated with clinical outcomes in real participant data?

Do these chemical exposures leave a detectable "fingerprint" on DNA that we can measure in blood?

Aim #1

How can we use AI/machine learning to prioritize chemicals for study?

Chemical, Biological and Toxicological Databases

HMDB · KEGG · UniProt · PubChem · ToxCast

All Chemical Exposures (N = Millions)

Priority Chemical Candidates (N = Hundreds)

Aim #2

Are prioritized chemicals associated with clinical outcomes in real participant data?

Chemical Data
Cognitive Decline
Disease Progression & Severity
Clinical Symptoms

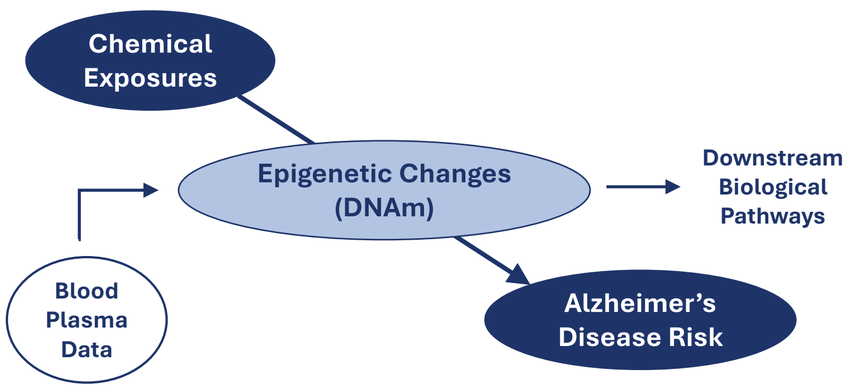
Cognitively Normal Adults:
Emory Healthy Brain Study
(N = 866)

Cognitively Normal Adults and Adults with AD:
Emory Alzheimer's Disease Research Center
(N = 567)

Blood Plasma Data

Aim #3

Do these chemical exposures leave a detectable "fingerprint" on DNA that we can measure in blood?



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