Understanding how inhaled particles impact the brain-blood-barrier (BBB)

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Background

- 50 million people live with dementia and this number is expected to triple over the next 30 years.
- The economic impact of dementia is significant. In the UK, the total cost of dementia is £34.7bn and will rise further to £94.1bn by 2040.
- In the 2020 update report of the Lancet Commission on Dementia Prevention, Intervention, and Care, air pollution was one of the three newly added modifiable life-course risk factors for dementia.
- COMEAP has identified the need to perform more mechanistic research to understand the potential and route by which particles reach the brain.
Cell biology assays

- Cytotoxicity by modified LDH assay

Figure 1. Cell viability of hCMEC/D3 cells after exposure to different particles.
Access facilities at CLF

• Using focused ion beam scanning electron microscopy (FIB-SEM) in correlation with confocal microscopy to observe particles directly at Blood-brain-barrier (BBB)
Access facilities at ISIS Neutron and Muon Source

- Using Neutron spectroscopy to identify the lipid dynamics after exposed to particles

*Figure 3.* (Left) QENS spectra obtained from LET Xpress run showing decrease in lipid dynamics due to presence of particles. (Right)
Combining a range of cutting-edge techniques through accessing the facilities at STFC, especially FIB-SEM in correlation with confocal microscopy, and neutron spectroscopy, allows us to understand more in depth how exogenous particles may egress the brain on the molecular and cellular levels.

Further resource has been obtained to continue this work:

- A UKHSA PhD studentship, titled “How Might Air Pollution Hurt the Brain? – Understanding the Impacts of Inhaled Particulate Matter on Neurological Health”.
- BBSRC STFC facility access fund for bioscience partnerships, “Development of a novel workflow for the efficient volume imaging of thick tissue samples with correlative light and electron microscopy”.