

## BIOMAGNETIC MONITORING FOR URBAN AIR QUALITY ASSESSMENT

Adrian Muxworthy (Imperial) and Gregg McIntosh (Canterbury Christ Church University)

**Background:** High-levels of urban particulate pollution are known to affect human health. European legislature states that the levels of particulate matter, so called PM<sub>10</sub> (particles < 10 µm in size), should not exceed 50 µg/m<sup>3</sup> on more than 35 days per year in a given city – unless their origin can be shown to be natural, e.g., volcanic ash. To try to meet these European requirements and to minimize high-levels of PM<sub>10</sub>, it is important to understand the origin of PM<sub>10</sub>, its spatial distribution and transport mechanisms.

However, current air quality networks obtain poor spatial monitoring resolution due to high investment and maintenance costs. Especially in heterogeneous urban environments, spatial monitoring resolution is generally too limited.

Biomagnetic monitoring of roadside plant leaves presents a promising monitoring approach to capture spatio-temporal variation of air pollution. Recently Hofman et al. (2017) evaluated biomagnetic monitoring of leaf-deposited particles for both air quality monitoring and modelling

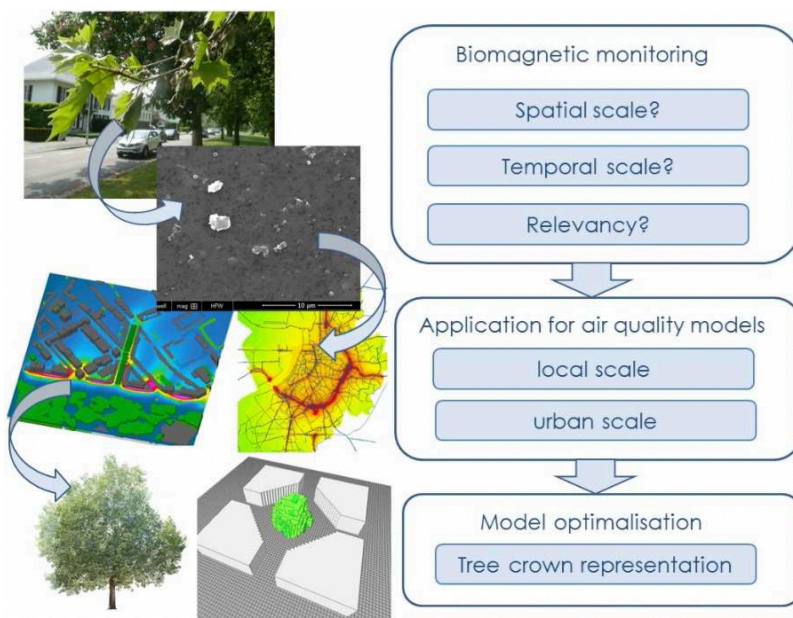


Figure 1. Schematic of planned PhD.

purposes, on both spatial and temporal resolutions. Nevertheless, lack of information on magnetisable composition and health-relevancy of magnetic minerals in atmospheric particles impedes the general application of biomagnetic monitoring in environmental air quality assessments. This research project aims to address this gap by evaluating the magnetisable composition of urban atmospheric particles in more detail, its potential for source attribution in urban areas, and the health-relevancy of biomagnetic properties. While the magnetic mineralogy, grain size and concentration will reflect PM source-contributions, associations with heavy metals and/or elemental carbon might emphasize biomagnetic monitoring as a novel health-related PM proxy.

**Project:** This PhD project aims to implement a large scale biomagnetic monitoring campaigns in London. This is a citizen-science project: As our research project strongly believes in citizen-science, voluntary citizens will be recruited to pick-up a strawberry plant and expose it for two months at their windowsills. Strawberry plants are chosen as monitoring species for their public attractiveness, their association with urban farming and scientific relevance with respect to the biomagnetic property measurements (leaf hairs favouring deposition and micro-surface roughness that impedes wash-off).

**Student Profile:** This project is a combined (urban) field and laboratory project, and would suit a candidate with an interest environmental science. Candidates should have a good degree in any area of science. Good laboratory skills also desirable, as are the ability to communicate with the general public.

Hofman, J., Maher, B. A., Muxworthy, A. R., Wuyts, K., Castanheiro, A., and Samson, R. (2017), *Biomagnetic Monitoring of Atmospheric Pollution: A Review of Magnetic Signatures from Biological Sensors: Environmental Science & Technology*, 51, 12,6648-6664, doi: 10.1021/acs.est.7b00832.

Please do not hesitate to contact me for further information and informal enquiries:  
adrian.muxworthy@imperial.ac.uk