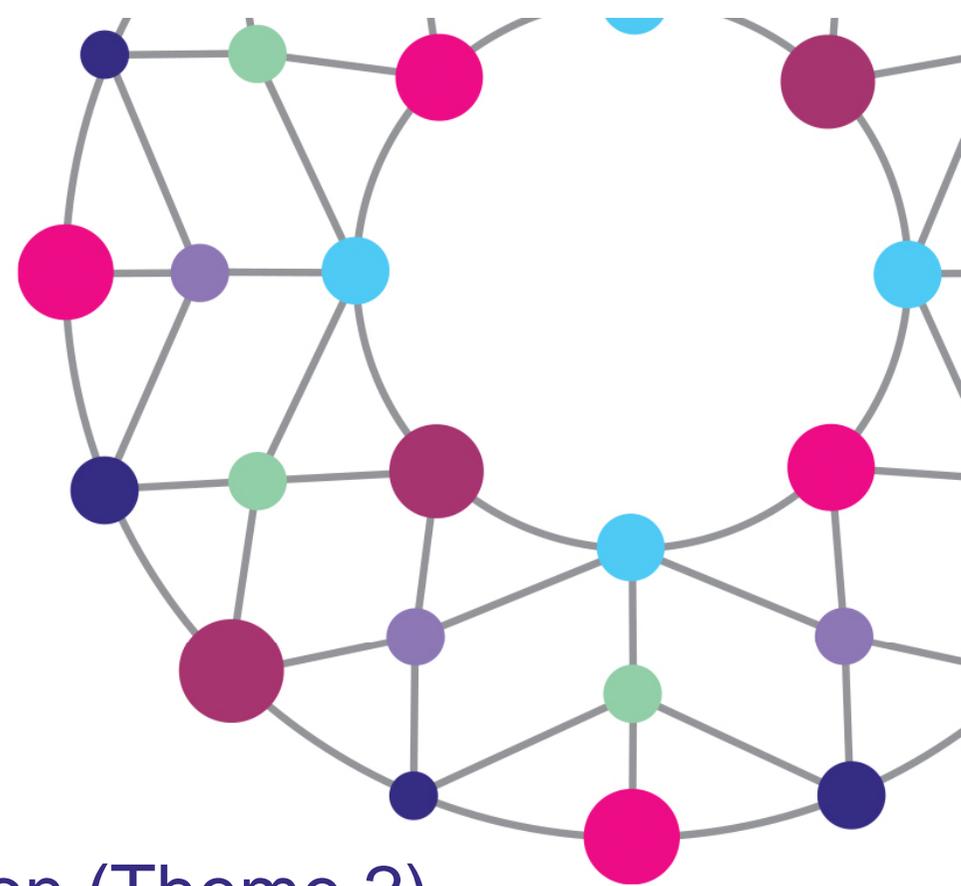


BioAirNet.



BioPM sampling and characterisation (Theme 2)

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www.bioairnet.co.uk

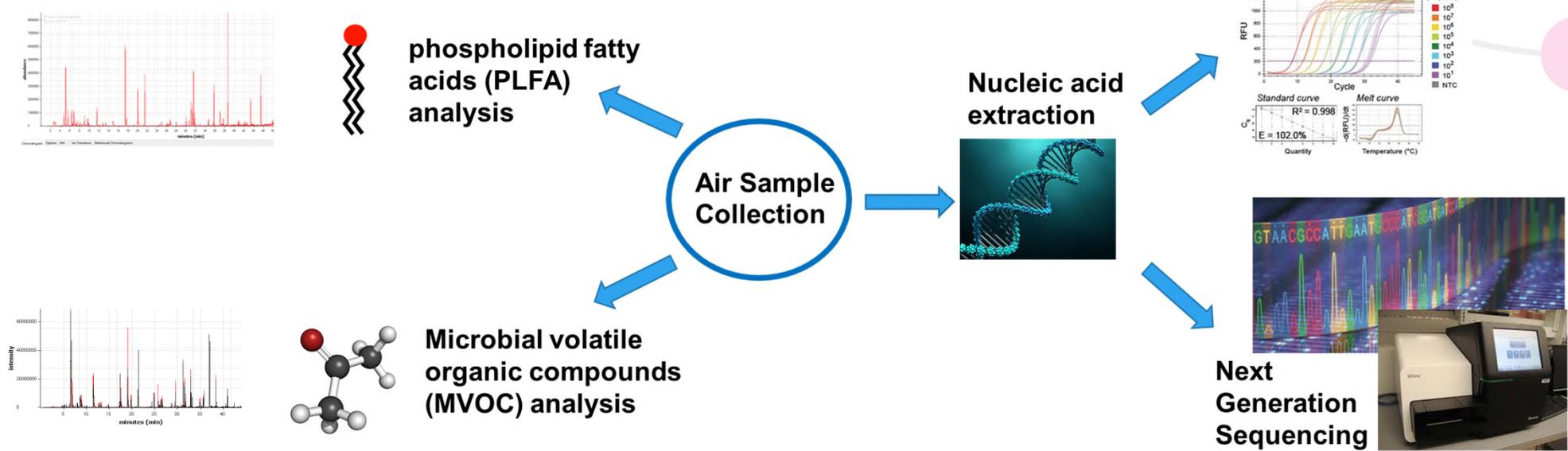


Theme 2 goal

To facilitate the translation of advances in fundamental science towards the characterisation and quantification of microbiologically active components of BioPM into technological solutions and process enhancements for end-users, stakeholder and regulators.



Analytical methods advancement



BioPM research has been significantly enhanced by advanced **analytical chemical and molecular tools**, which allow for a **faster, more sensitive** and **highly detailed characterisation** of air samples (Ferguson et al. 2019 *Mol. Ecol. Res.* 19:672-690. Garcia-Alcega et al. 2018. *Sci Total Environ*, 631, 1059-1069)

But.....



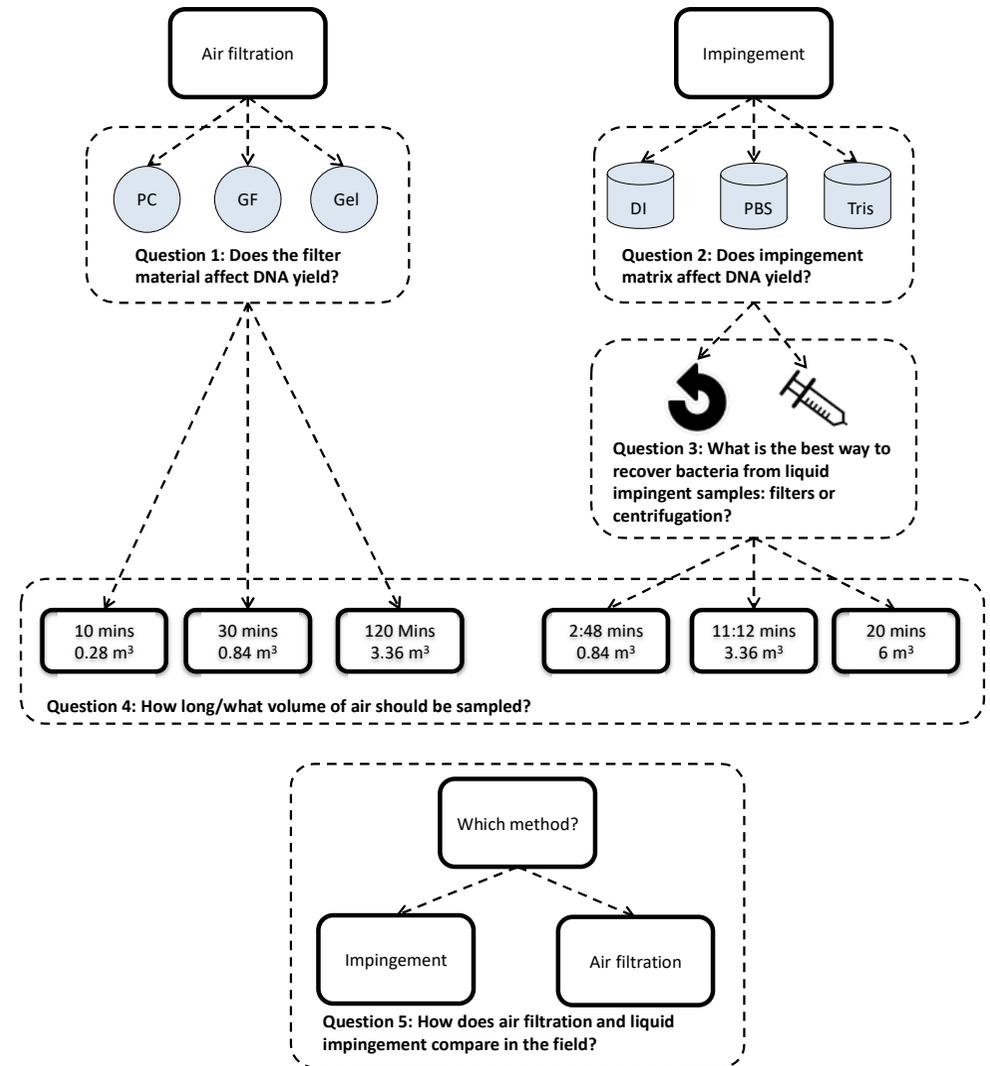
- Differences in sample collection
- Differences in cell and DNA extraction efficiencies
- Biomarkers remain poorly identified and quantified
- Microbial abundance and biodiversity are often underestimated

As a result of the above is often difficult to link specific BioPM components to diseases, assess exposure levels and human health risk.

Another important consideration

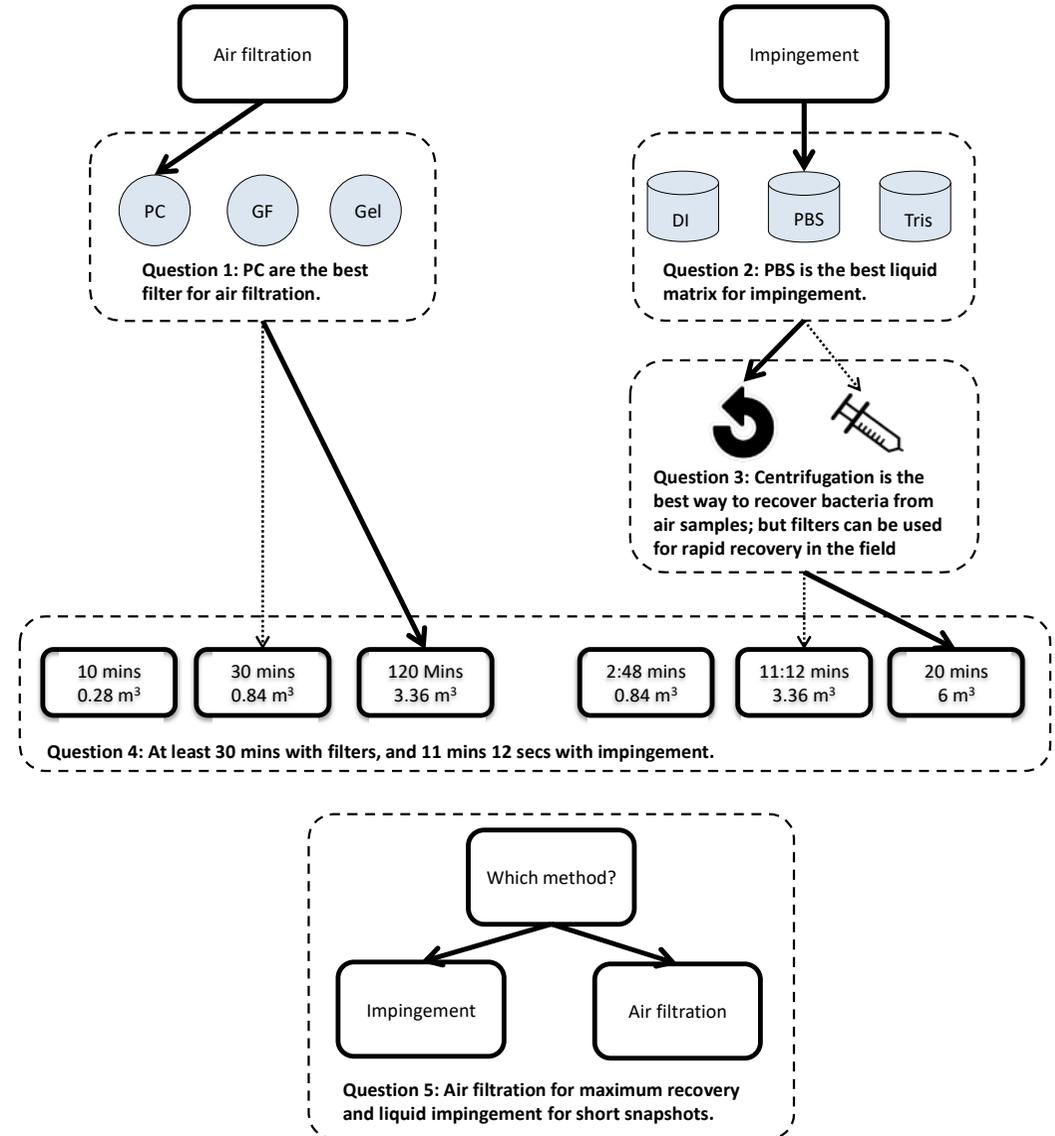
There is currently **no standardised sampling strategy**. “*How do I sample?*”

But more than this... sampling strategy by the user may ‘skew’ the data. So the choice of sampling strategy depends on the question being addressed.

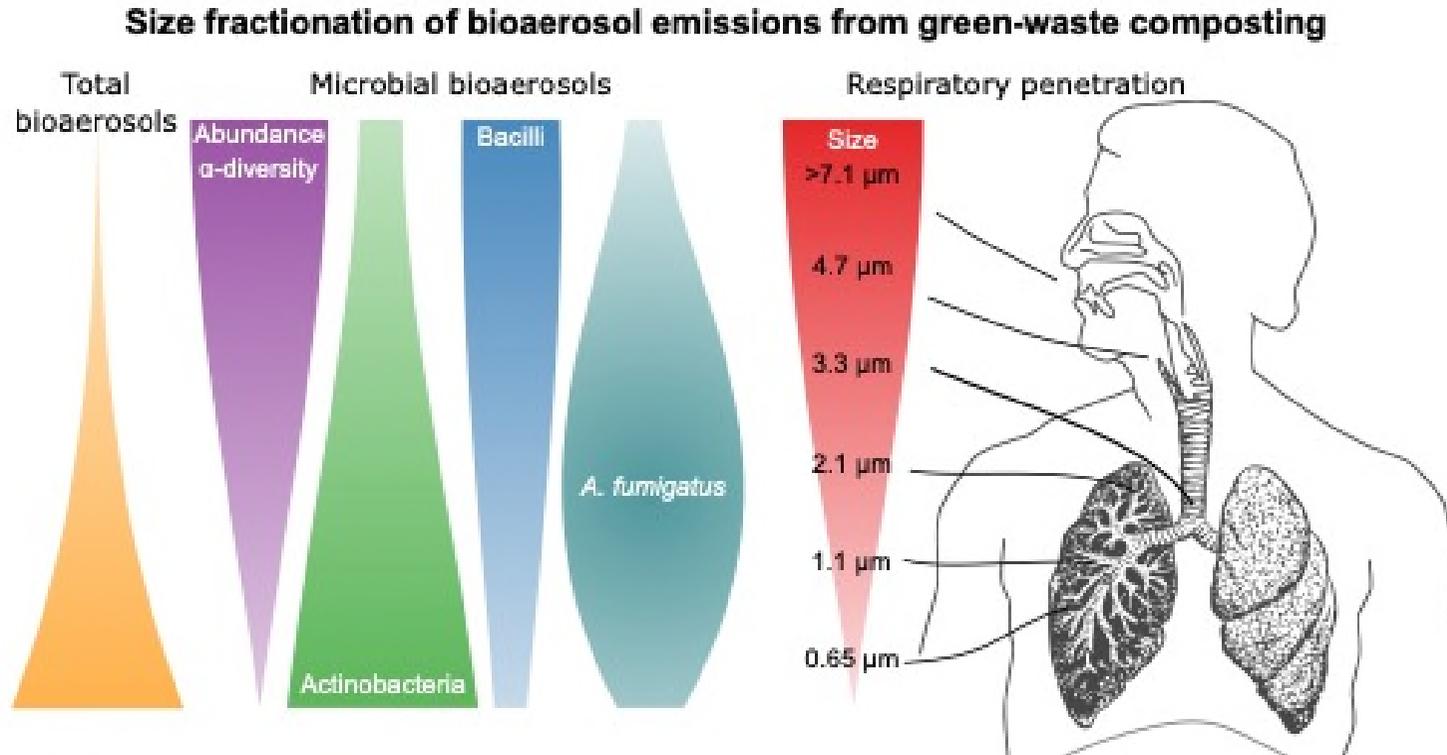


Some way forward !

We have developed optimal methods for each approach and have designed user friendly guidelines and recommendations of the optimal methods.



Size matters !



Must be accounted for in dispersion modelling and public health risk assessment

What's next ? Loop-mediated isothermal amplification (LAMP)

Low-cost sensing technologies advancements

- Colour-change assay that could be used as a rapid 'in-field' sensor for detecting (and enumerating) key pathogens
- Act as "early warning detection systems" to characterising high-risk environments and limiting exposure across the indoor/outdoor continuum.

LAMP has potential to impact on bioaerosol monitoring and public health.

Quote from EA "LAMP looks really promising if we can come up with the right marker organisms."

Rapid Pathogen Detection System (BIO-RaPaDs)

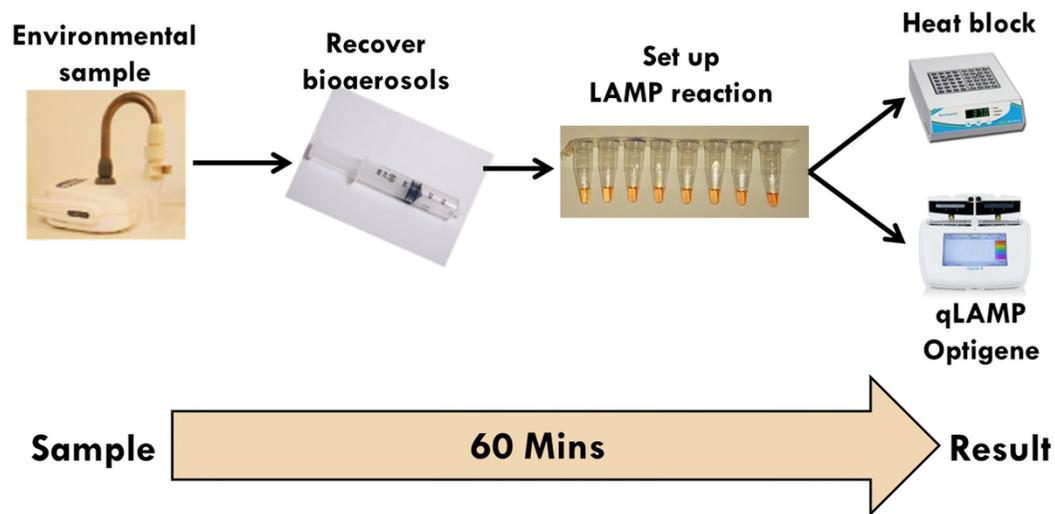


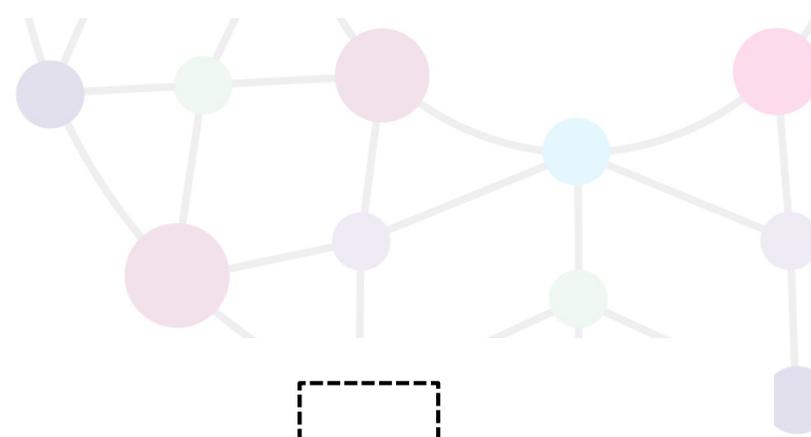
We have developed a portable micro-instrumentation for real-time wide-area rapid detection of pathogens

Detects as low as 4 cells in <30 mins.

Tested on *A.fumigatus* plus a range of bacterial pathogens e.g. *Mycobacterium* spp.; *Legionella* spp. plus others.

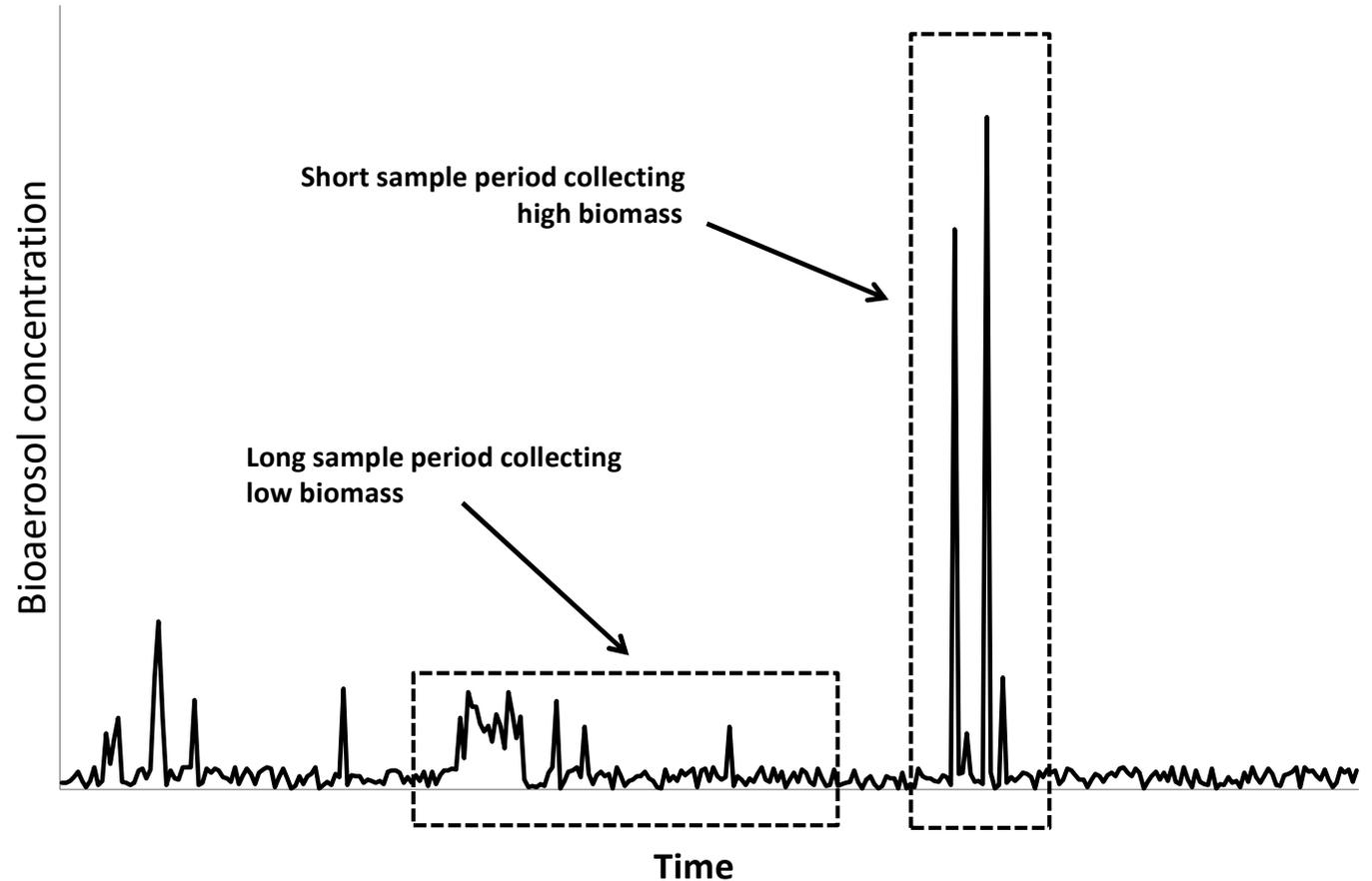
Rapid, sensitive, user-friendly method.





Good but another important consideration

These methods often only provide a “*snapshot*” characterisation in time.



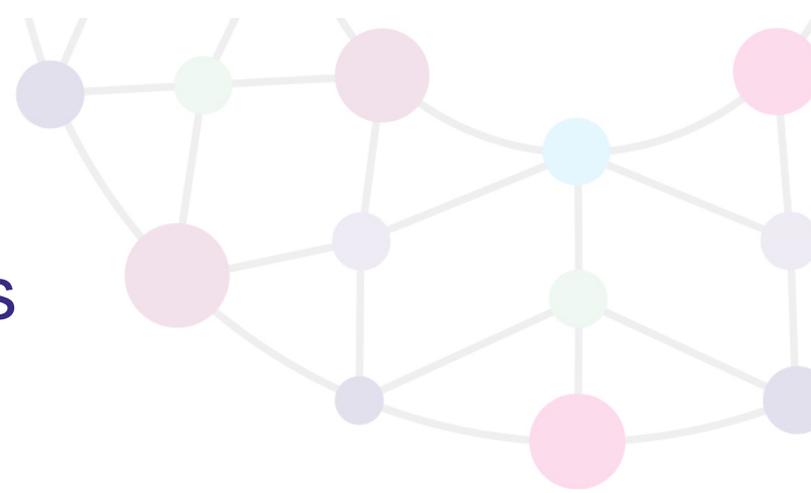
SIBs-Spectral Intensity Bioaerosol Sensor (SIBS)

- One of the most advanced real time methods
- Discriminate between BioPM types depending on their biofluorophore signatures (Nasir et al. 2018, 2019).

There are still significant challenges to use such systems to quantify BioPM emissions in the context of public health.

New system thinking analysis approach is needed to gain a holistic understanding of BioPM sources and exposure pathways.





Take home message and future needs

What information do we need?

Differentiation of sources?

Sampling and detection systems capable of offering particle size fractionated and spatio-temporal measurements in real time are important.

Which method(s) do we use?

Depends on the Q being asked.

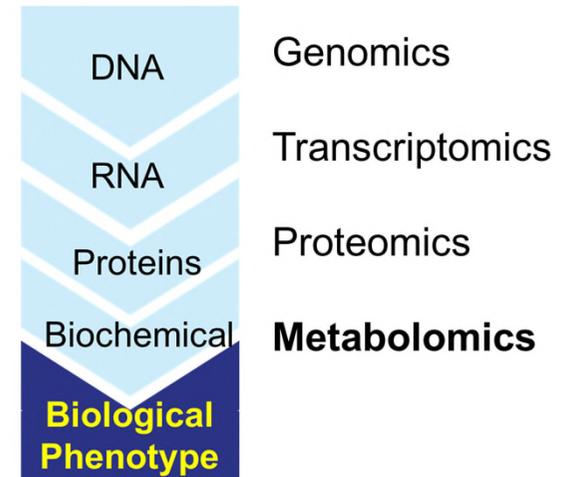
Do we need combinations of methods?

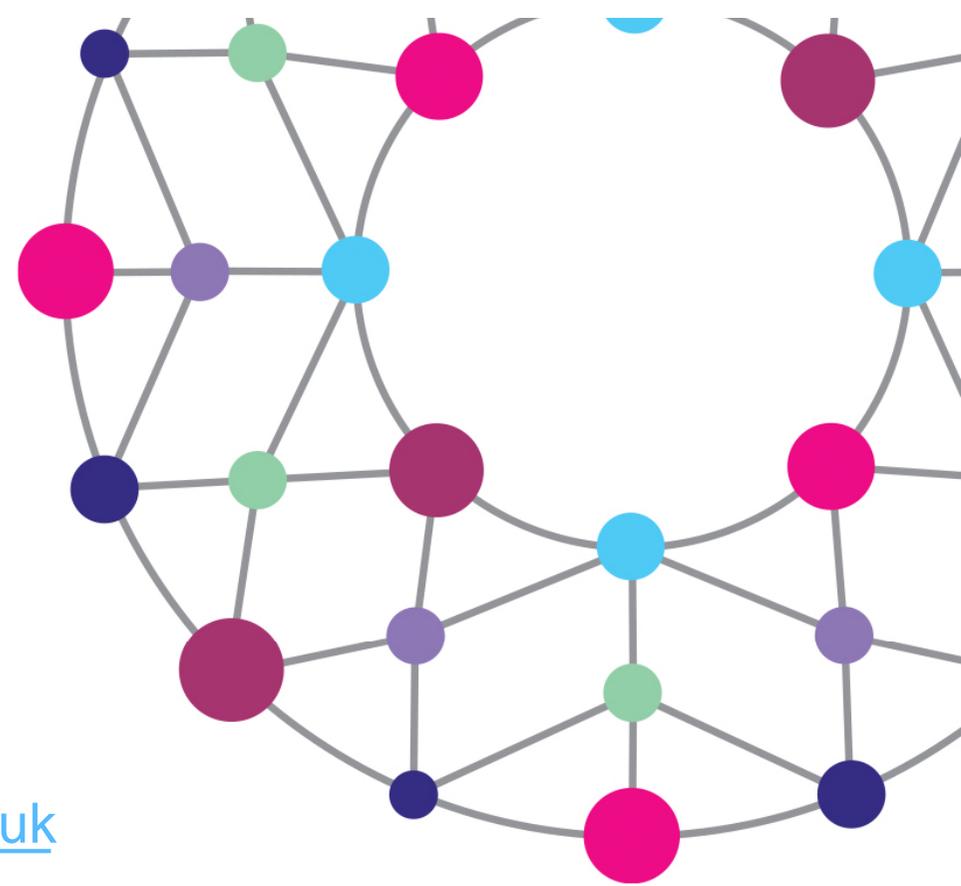
What about air sample collection methods?

e.g. passive samplers vs personal samplers

What opportunities next? Want to be involved?

Comments from the network.





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