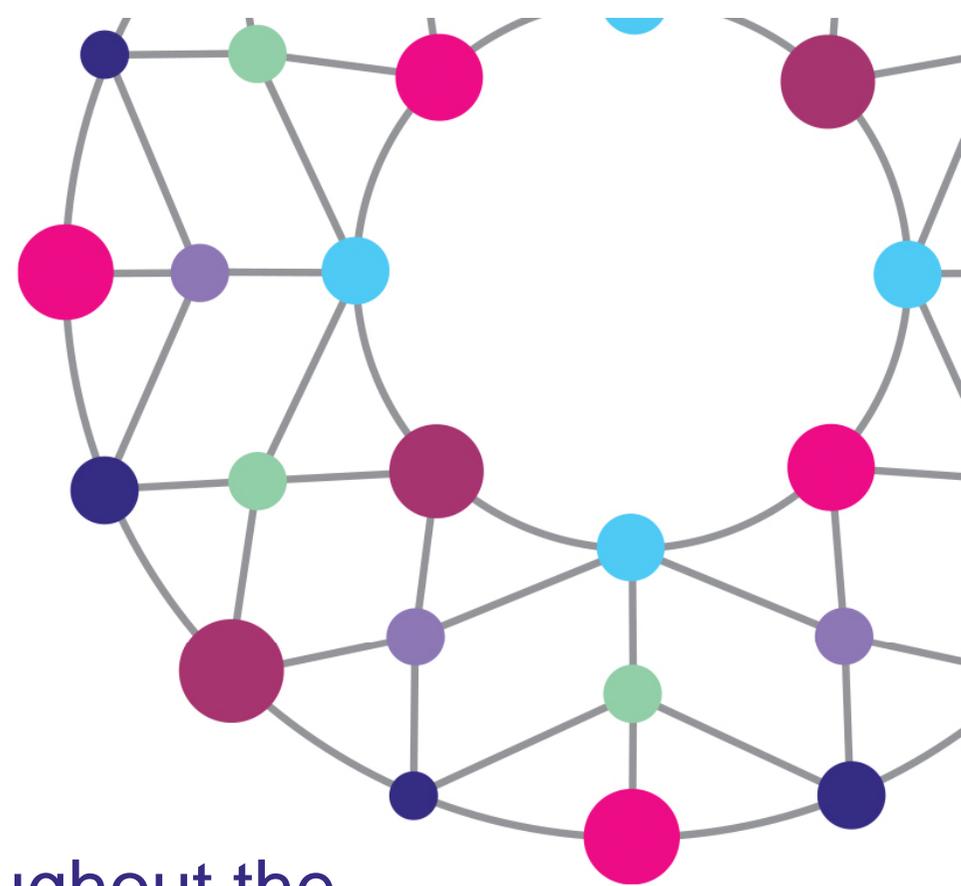


BioAirNet.

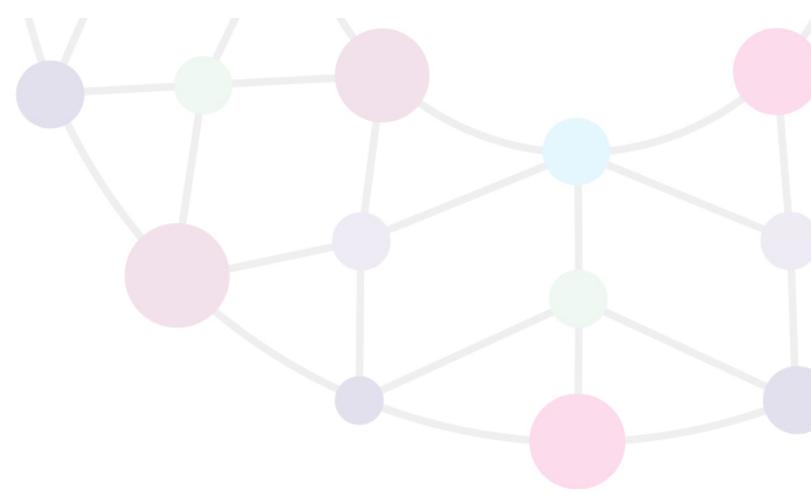


BioPM sources and dynamics throughout the indoor-outdoor continuum(Theme 1)

Ian Colbeck and Sean Tyrrel

04/01/2021

www.bioairnet.co.uk



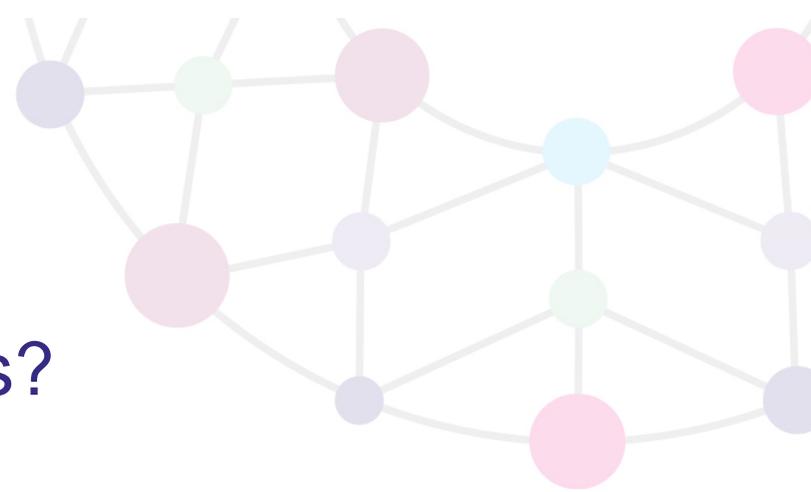
BioPM – what is it?

- Aerosol of biological origin
- Term “bioaerosol” widely used
- Often associated with viable organisms
- Extend the definition – BioPM may be cellular, viral, components of cells, aggregates of biological matter, aggregates of biological and non-biological matter
- BioAirNet aims to
 - Break down traditional aerobiological disciplinary silos
 - Break down traditional biological and physico-chemical PM silos



BioPM – where is it and where does it come from?

- It's ubiquitous in the troposphere – in indoor as well as outdoor air
- Diversity & concentration variability driven by complex emission and post-emission processes
- BioPM is emitted in the natural world
- BioPM emissions are modified by agricultural and industrial processes and by the creation of indoor environments
- Tendency for BioPM science to be compartmentalized into outdoor and indoor environments



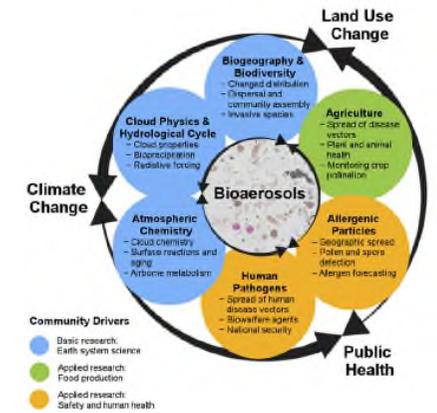
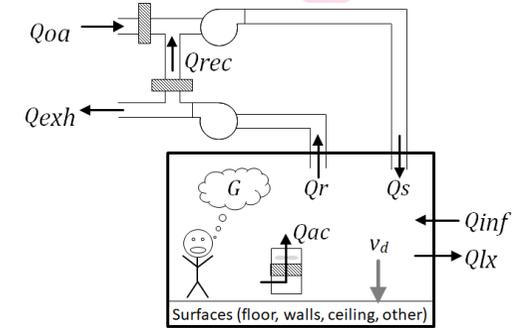
BioPM emissions – research questions?

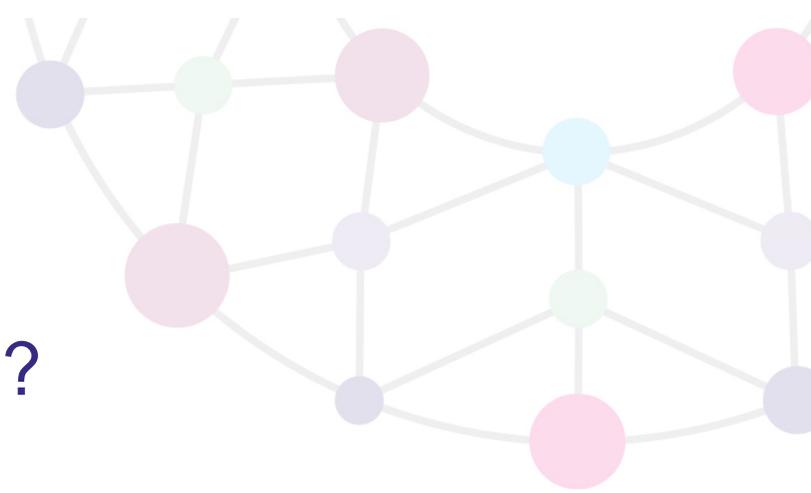
- How might detection and analytical advances help us to understand the biological and non-biological characteristics of complex BioPM particles?
- How can we view BioPM holistically and specifically take a “bioexposome” approach to exposures in people’s daily lives?
- How might the semi-natural & built environments be designed, modified and regulated to encourage “healthy” exposures to BioPM?
- How might climate change and the energy-efficient buildings of the future change emissions of BioPM?



Modelling

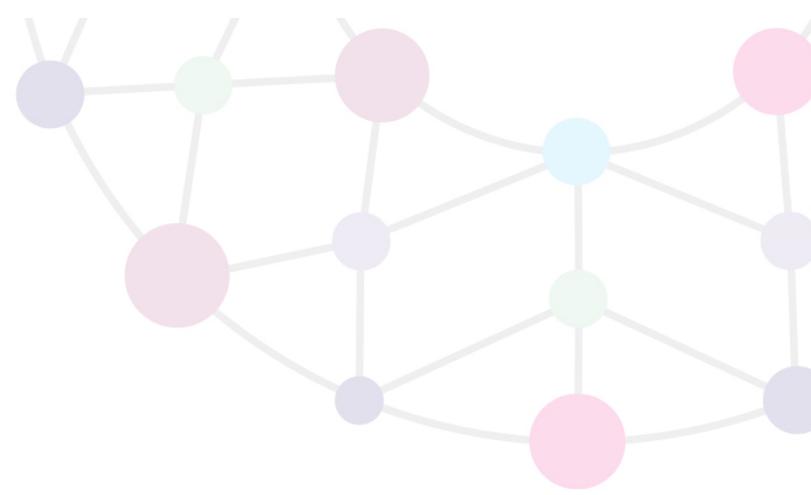
- **Indoors** - Lots of recent research relating to Covid-19
- SAGE, Royal Society ([Rapid Assistance in Modelling the Pandemic](#)), NIST ([FaTIMA](#)), [SAFEAIRSPACES COVID-19](#)
- *Outdoors* –
- Roles of bioPM in the environment: the hydrologic cycle, cloud condensation and ice nucleation
- Changes in biodiversity due to climate change and evolution of microorganisms





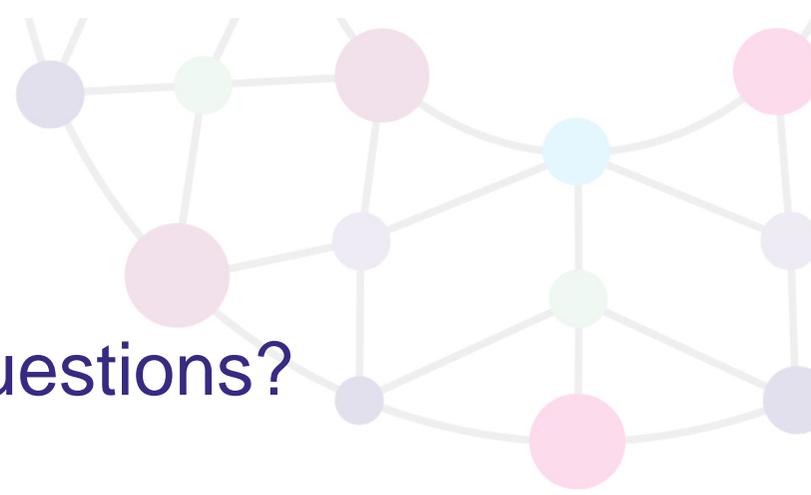
BioPM modelling – research questions?

- What is the impact of the environment on the biological properties of bioaerosols?
- How can models be developed to evaluate risk of indoor near- and far-field (>2m) exposures, using parameters such as ventilation rate, the duration of exposure, environmental conditions and occupancy?
- How can we reduce the uncertainties in emission and deposition flux estimates?
- Bioaerosols are dynamic components of the atmosphere; How do models consider such factors as evaporation, condensation, UV radiation, oxidation and what impact do these have on viability and toxicity?
- How well validated are these models?



Engineering control measures

- SAGE – [Environmental and Modelling Group](#)
- [Canadian Government](#)
- [US EPA](#)
- HEPA filters, UV-C
- Unlikely to have significant benefit unless the airflow rate through the device is sufficient.
- Ventilation becoming more important - building guidance typically recommends 8-10 l/s/person for most environments based on design occupancy



BioPM control measures – research questions?

- How valid is the assumption that CO₂ be used as an indicator of poor ventilation?
- Are people aware of the importance of ventilation in the home?
- What information is available regarding their use in the home when purchasing an indoor air cleaner?
- How effective is direct sunlight in the home at reducing the viability of BioPM?