Methods for Sampling Bioaerosols in Earth's Troposphere & Stratosphere

CH Session 4, Detection Mechanisms – Oct 5, 2019

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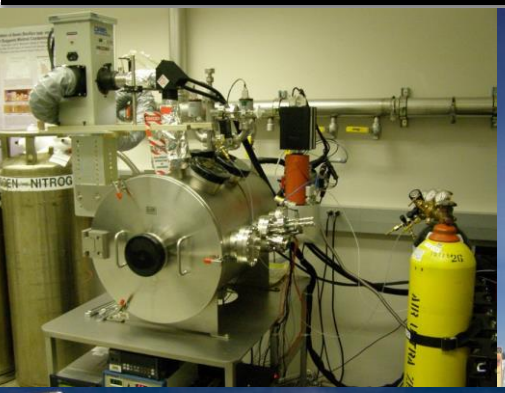
NASA Aerobiology Laboratory

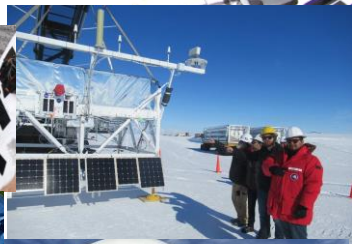






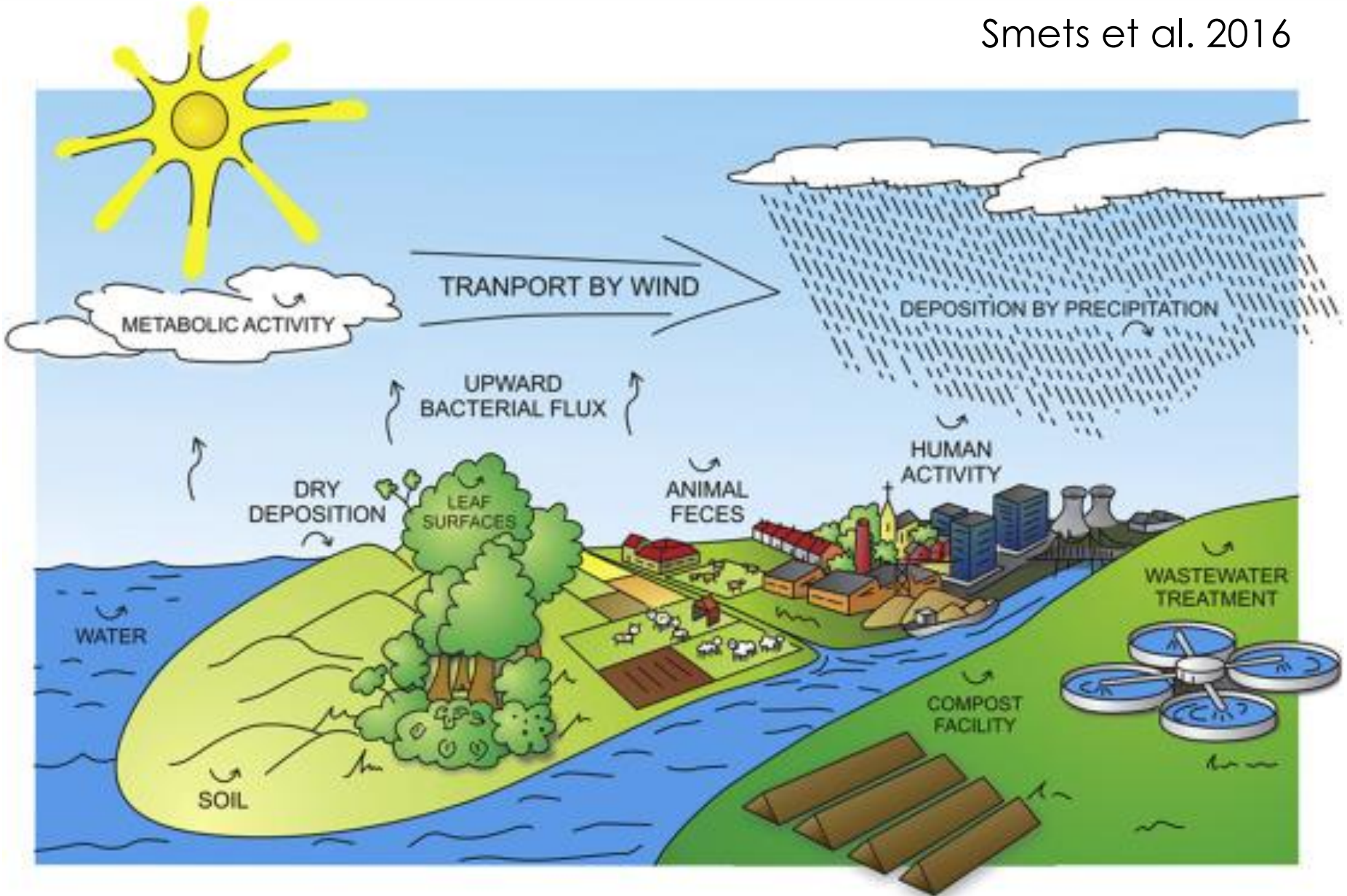




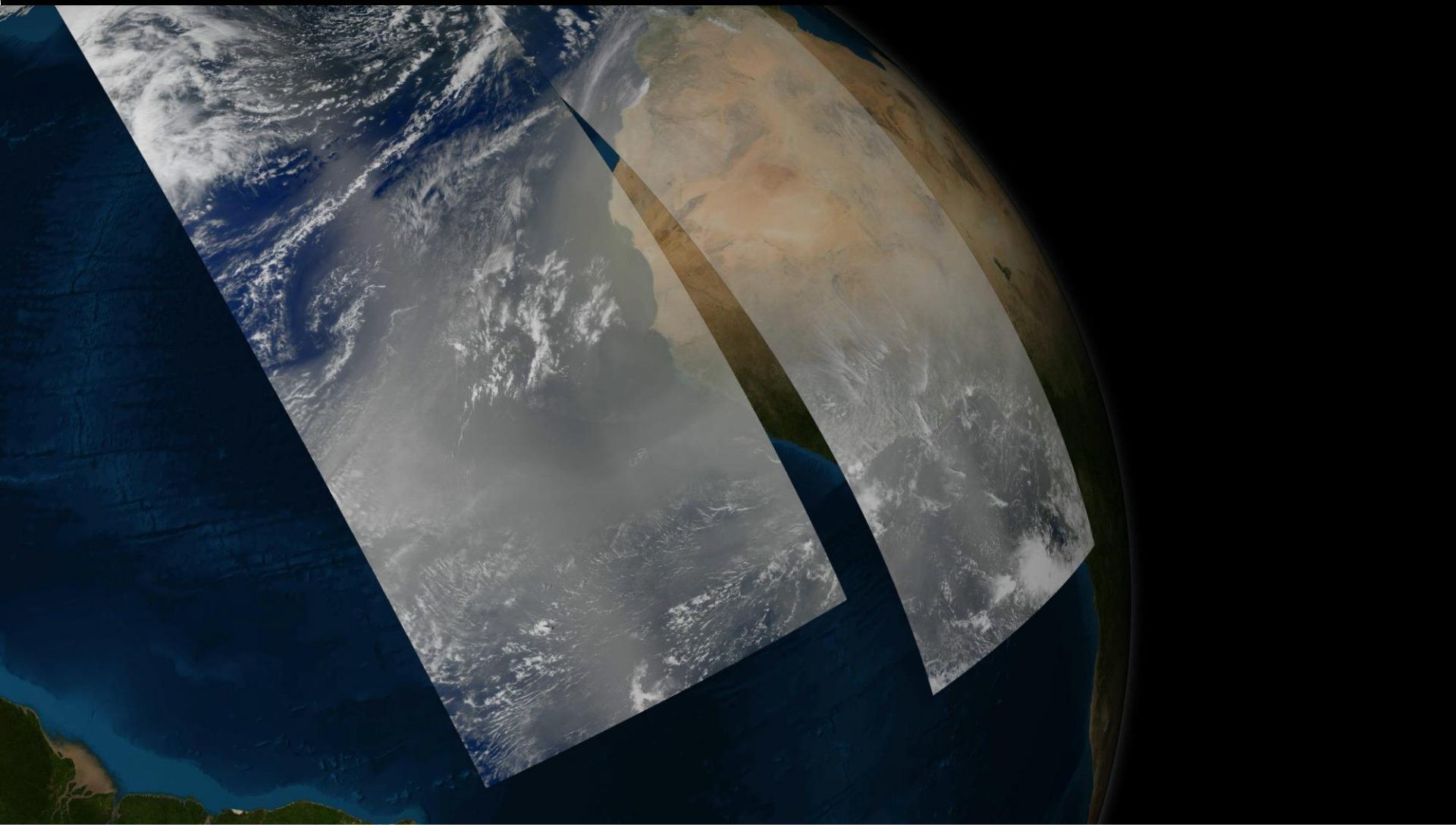



Bioaerosols: Sources and Sinks

Smets et al. 2016

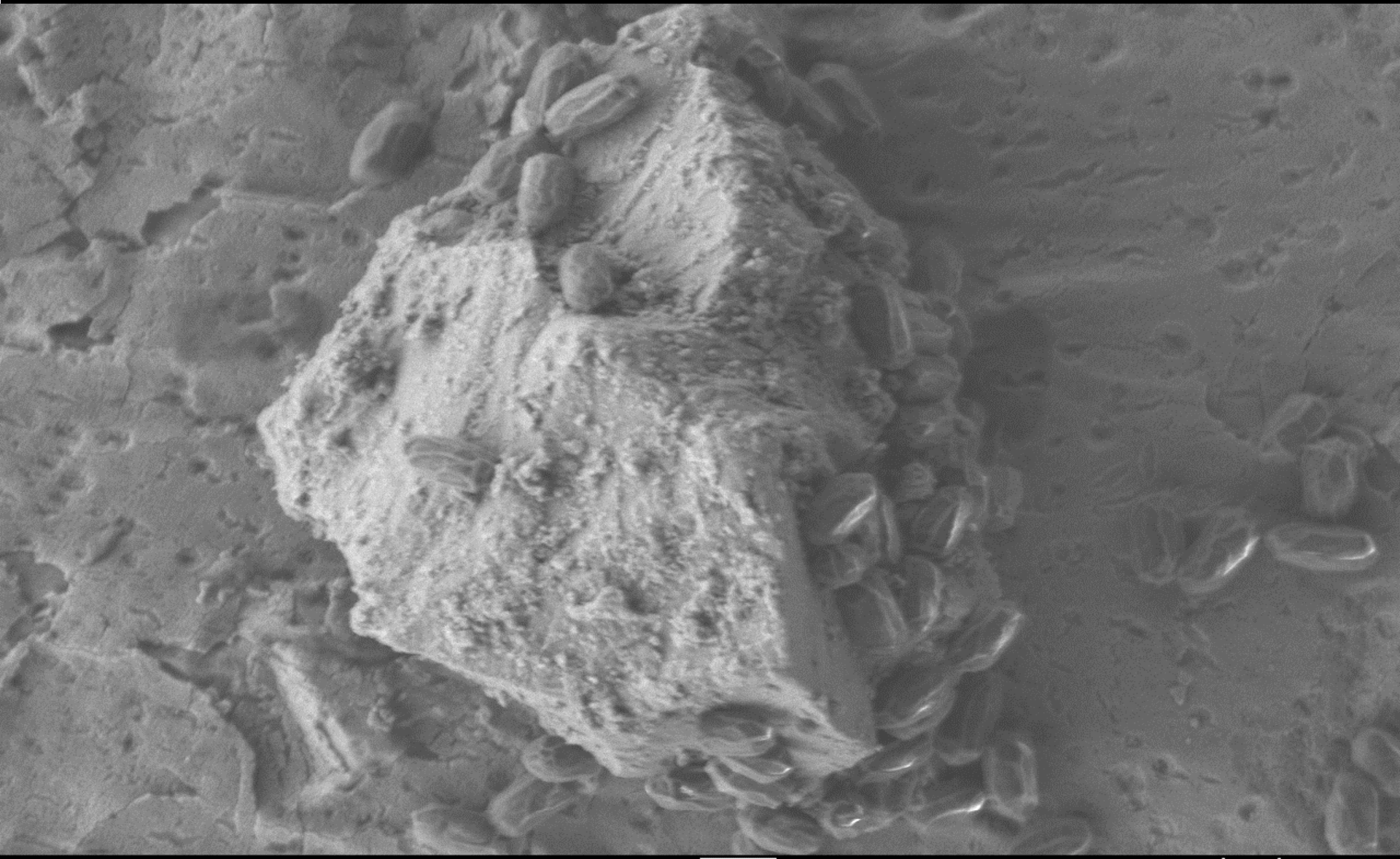


Aerobiology: Follow the Dust



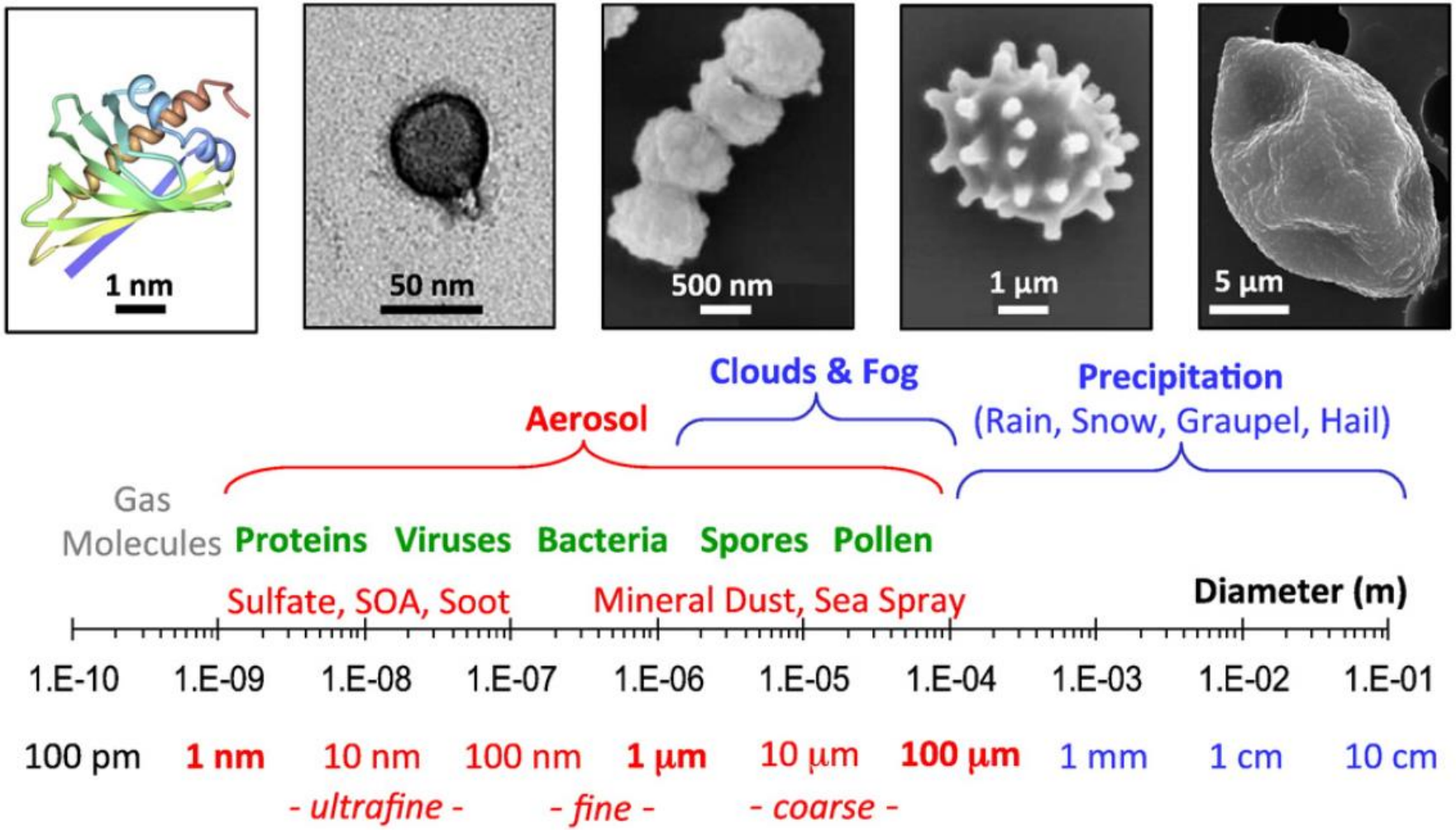
Courtesy of Goddard Scientific Visualization Studio (SVS) using CALIPSO data
Yu et al. (2015)

Bacterial Hitchhikers



Biological Aerosols (Bioaerosols)

Fröhlich-Nowoisky et al. 2016



Aerobiology Essentials

COLLECT

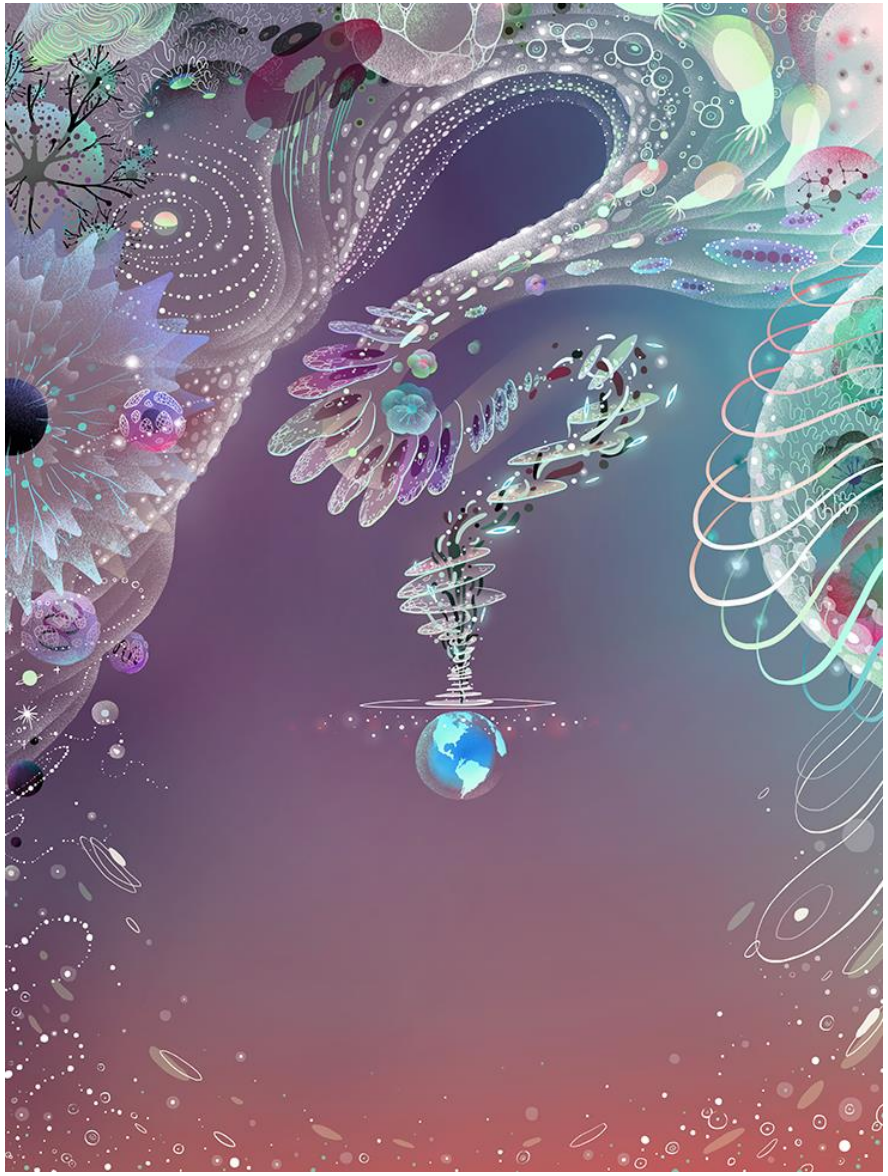
Passively	Actively

CONCENTRATE

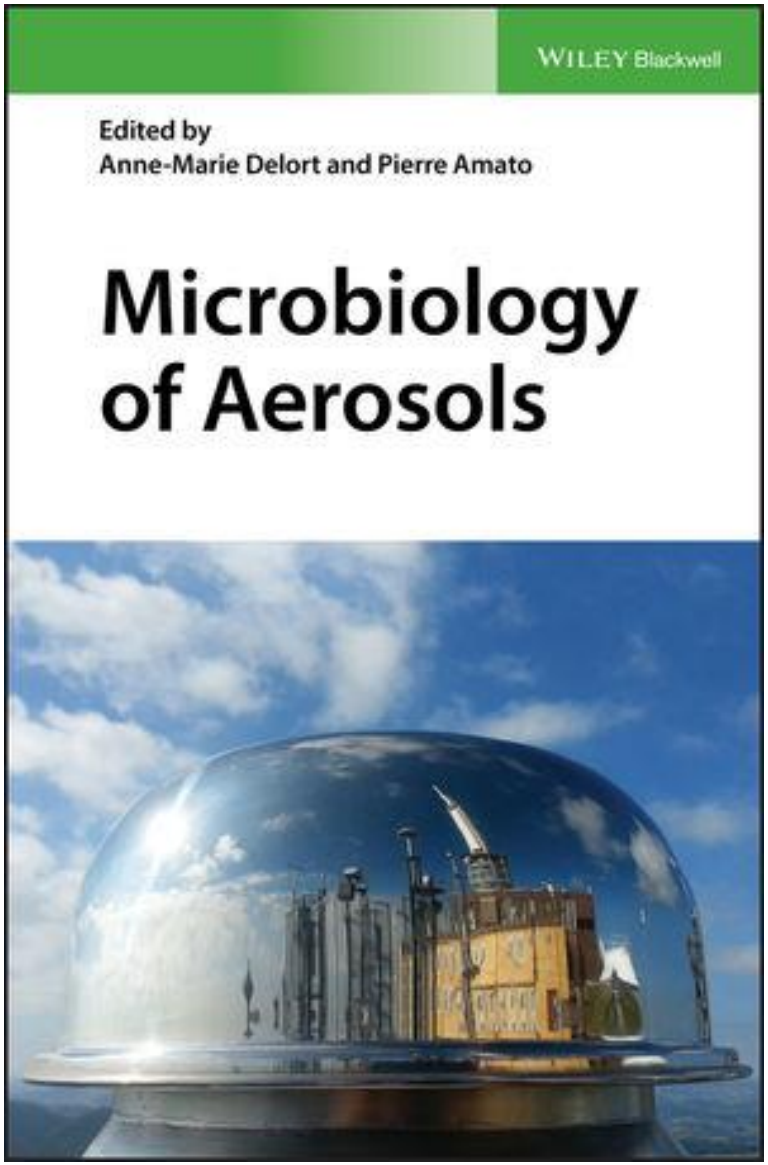
Separate	Purify

ANALYZE

Offline	Online



Aerobiology Review Chapters



Chapter 1.2 | Token Access

Sampling Techniques

P. Amato, E. Brisebois, M. Draghi, C. Duchaine, J. Fröhlich-Nowoisky, J.A. Huffman, G. Mainelis, E. Robine, M. Thibaudon

Book Editor(s): Anne-Marie Delort, Pierre Amato

First published: 22 September 2017 | https://doi.org/10.1002/9781119132318.ch1b | Cited by: 1

- Filtration
- Sedimentation
- Impaction
- Centrifugation/cyclone
- Impingement
- Electrostatic precipitators

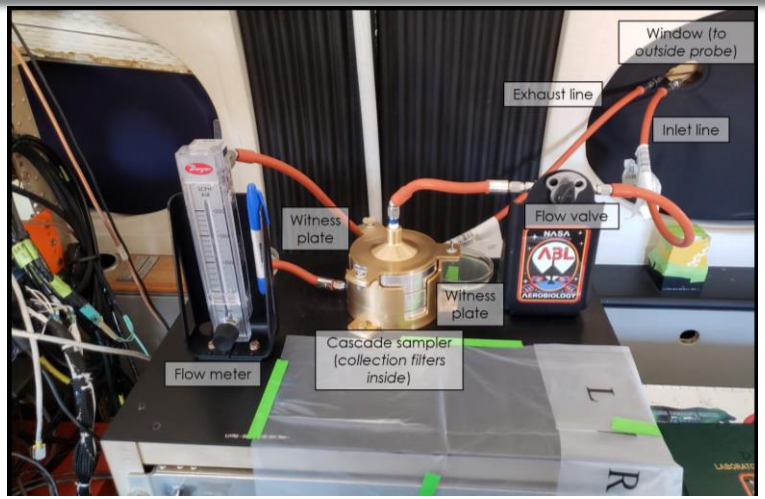
Earth Case Study: Balloons

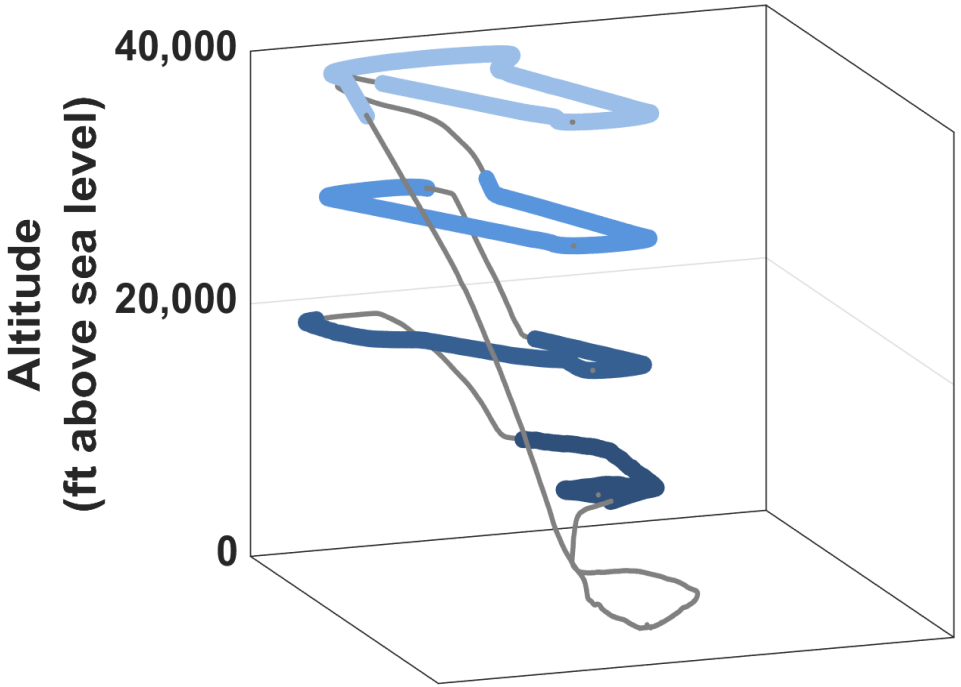
Bryan et al. 2019

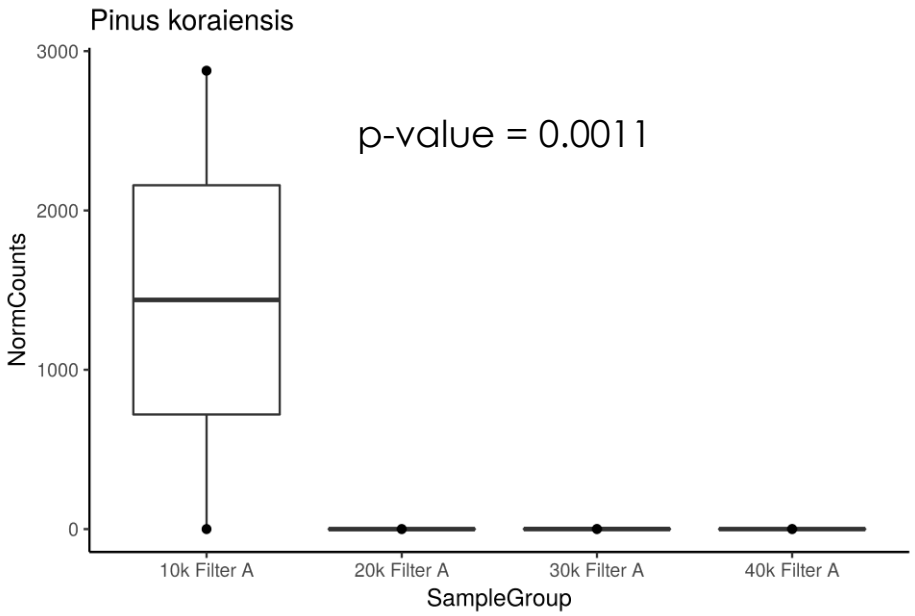
Vega (credit: G.A. Landis)

Case Study: Smith et al. 2018

C20A aircraft
(< 1133 kg)
Up to 12 km

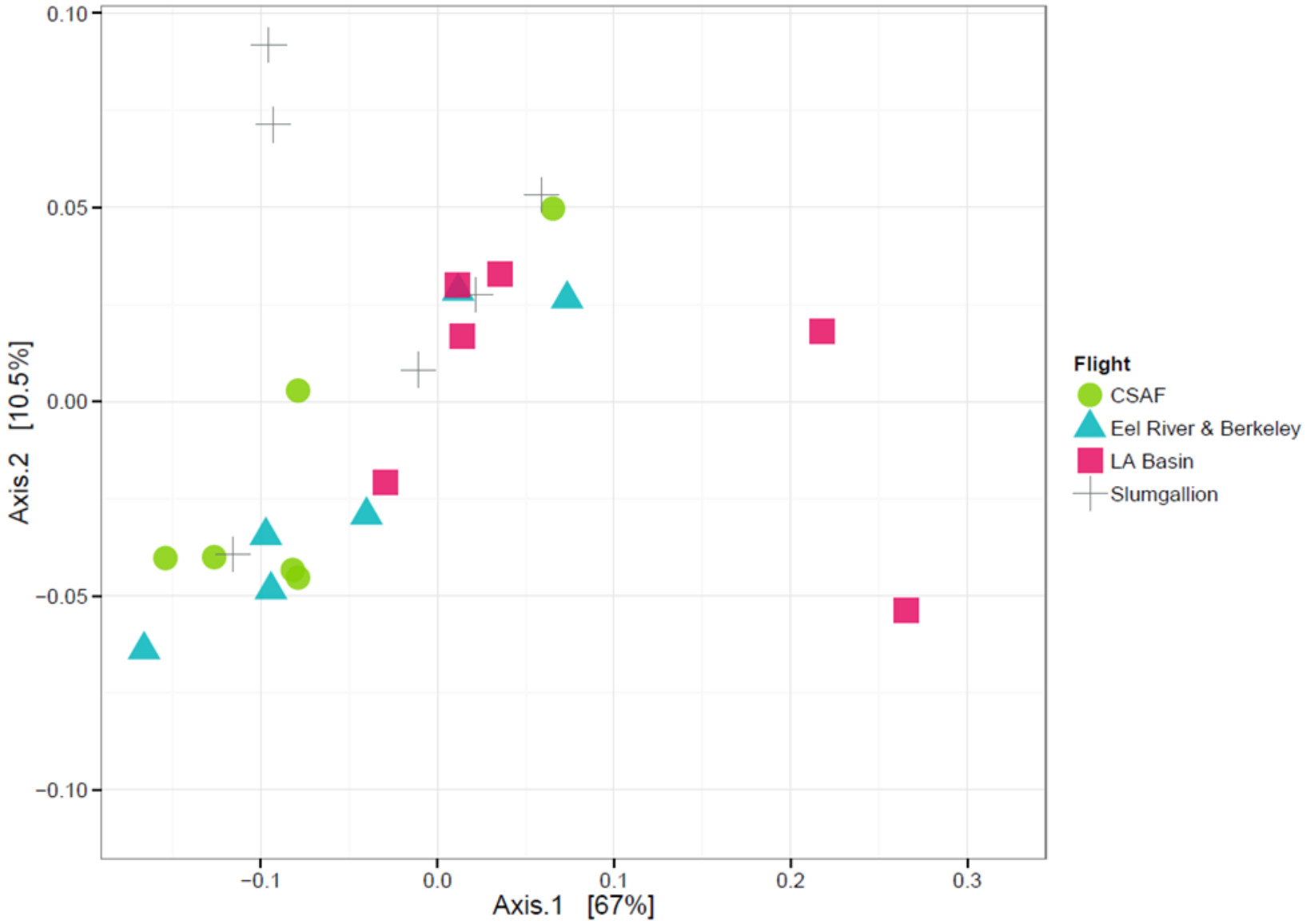






Jaing et al. (unpublished)

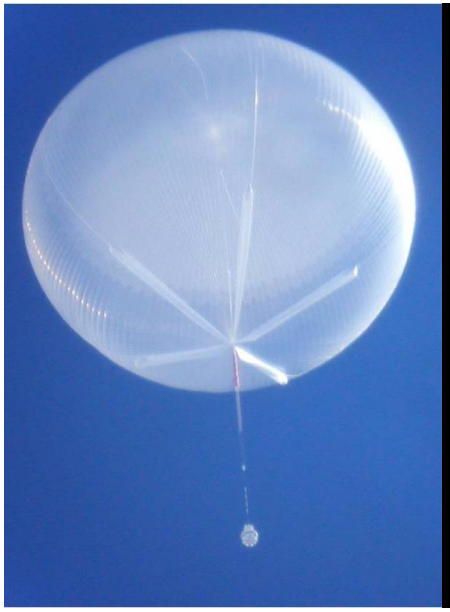
Case Study: Smith et al. 2018



Case Study: Bryan et al. 2019

Meteorological balloon
(< 10 kg)
Up to 29 km

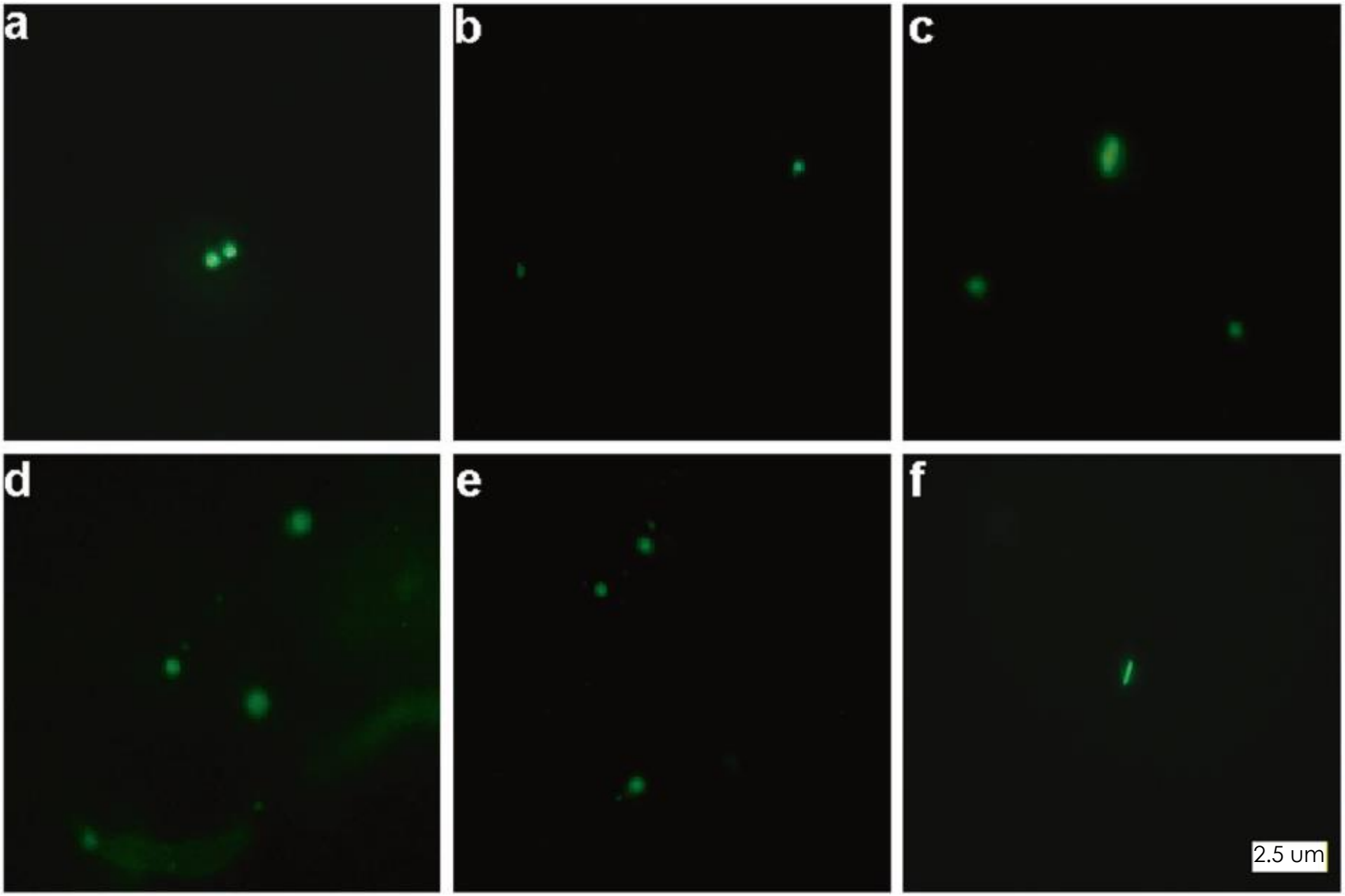
Large scientific balloon
(< 2700 kg)
Up to 38 km



HADES Flight

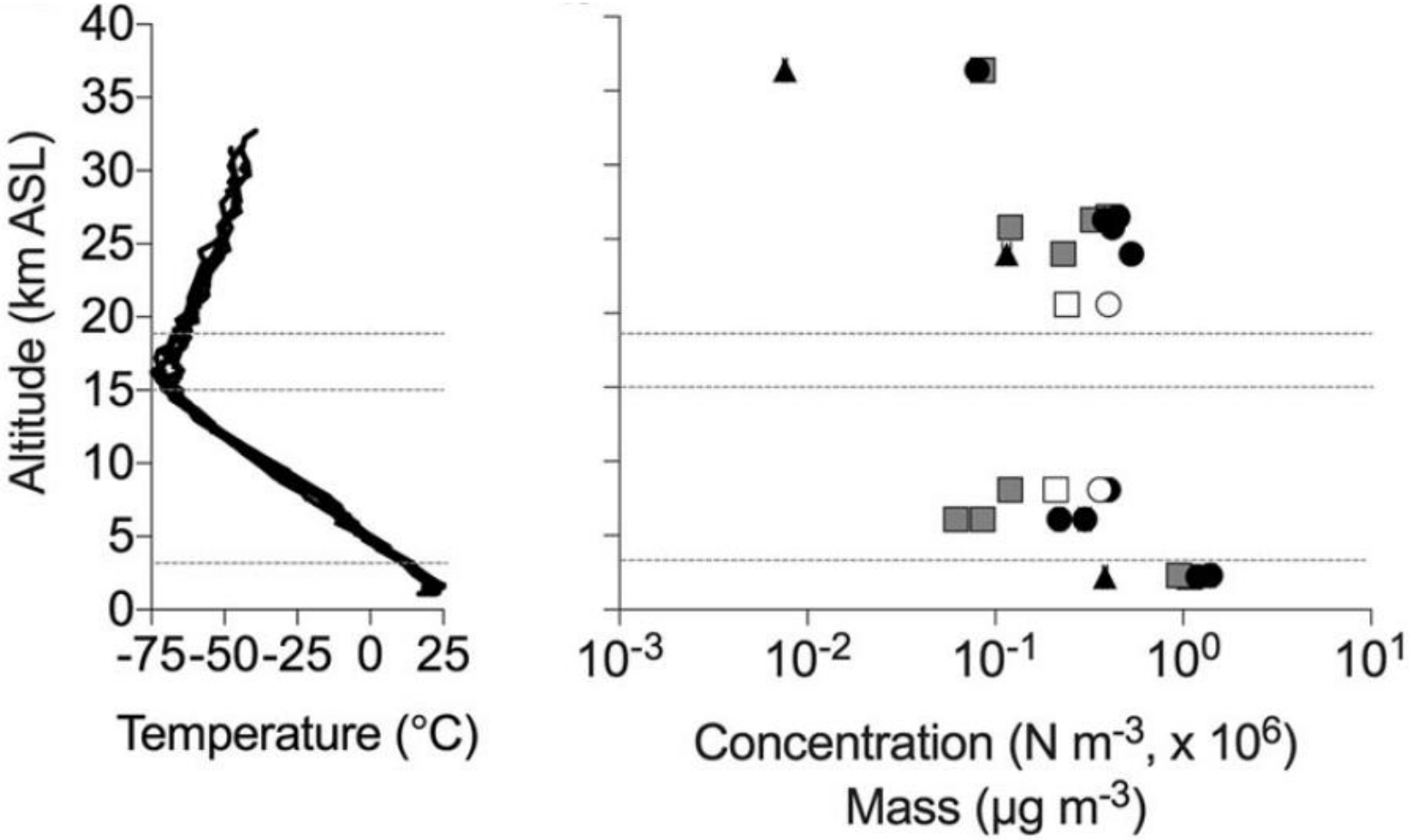
HASP 2013
09/02/2013

Case Study: Bryan et al. 2019

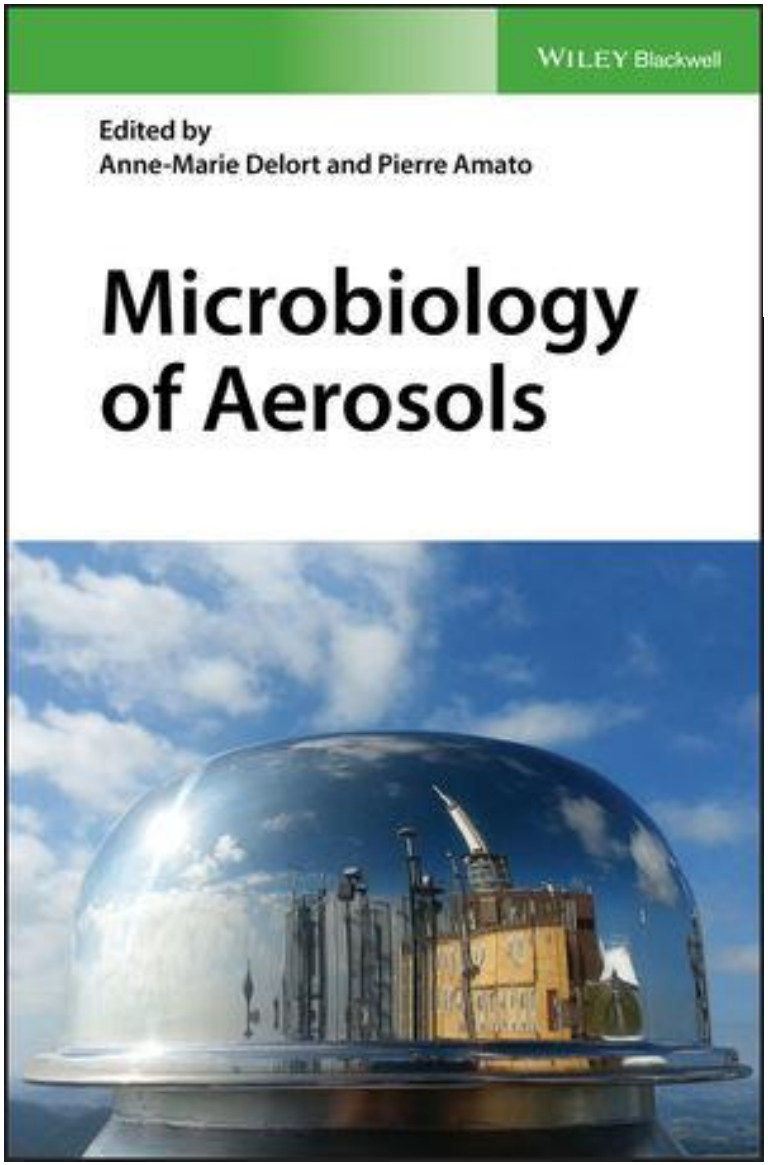


Case Study: Bryan et al. 2019

Extrapolation of the cell and biomass concentration data implies the atmosphere (i.e., from the surface to 40 km) may contain ~10^{24} cells… this estimate… suggests the stratosphere could harbor ~40% of all bioaerosols.



Aerobiology Review Chapters



Chapter 1.4 | Token Access

Online Techniques for Quantification and Characterization of Biological Aerosols

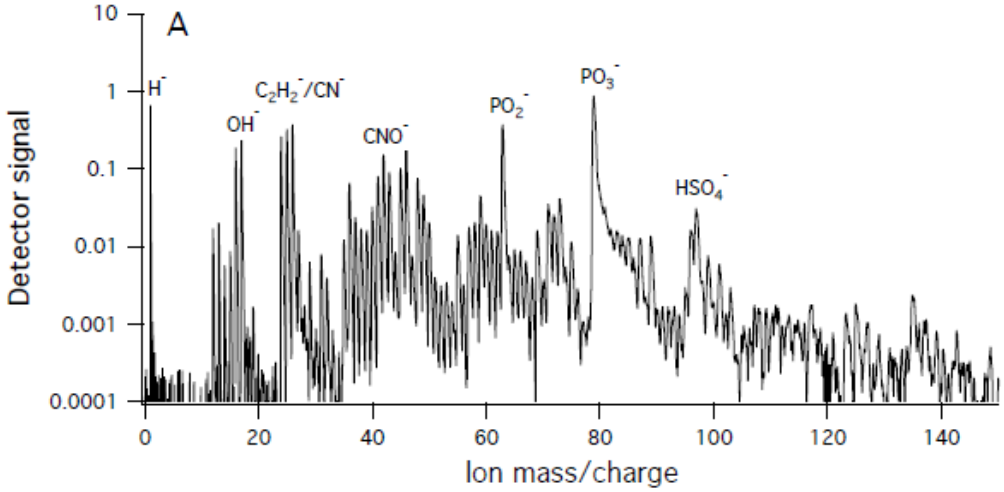
J.A. Huffman, J. Santarpia

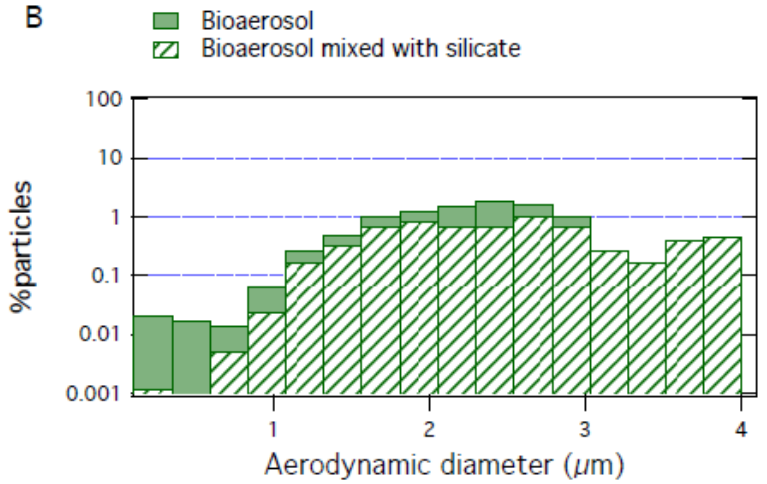
Book Editor(s): Anne-Marie Delort, Pierre Amato

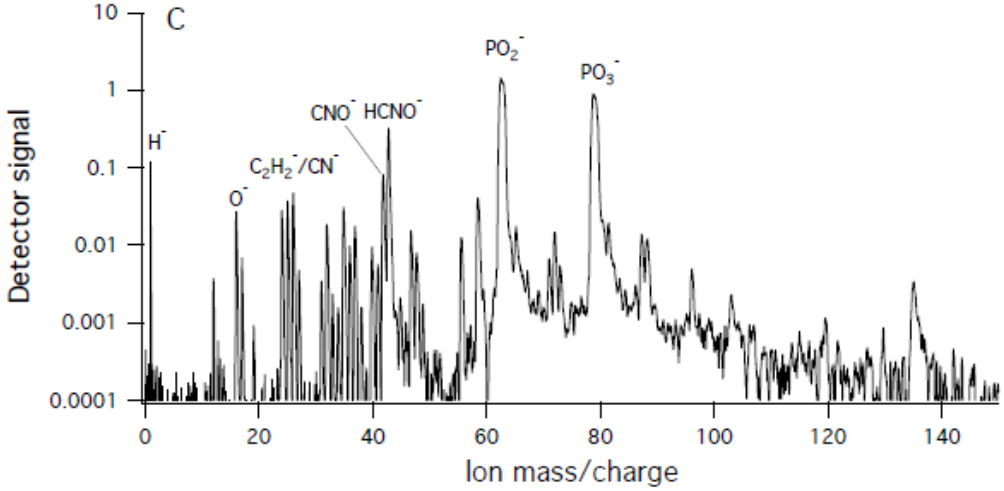
First published: 22 September 2017 | https://doi.org/10.1002/9781119132318.ch1d | Cited by: 3

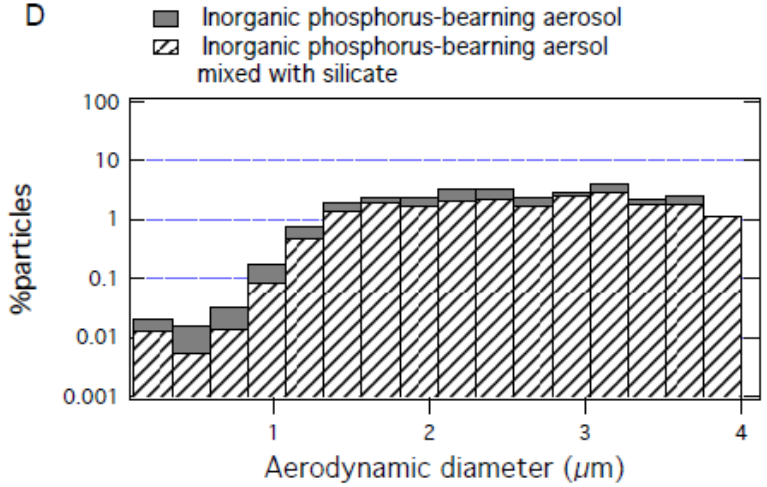
- Single-particle fluorescence spectroscopy
- Two-wavelength single-particle fluorescence analyzer
- Fluorescence aerodynamic particle sizer (FLAPS)/ultraviolet aerodynamic particle sizer (UV-APS)
- Wideband integrated bioaerosol sensor (WIBS+) and spectral intensity bioaerosol sensor (SIBS)
- Bioaerosol mass spectrometer (BAMS)
- Aerosol time-of-flight mass spectrometer (ATOFMS)
- Aerosol mass spectrometer (AMS)
- Resource effective bioidentification system (REBS)
- Molecular tracer techniques

Case Study: Zawadowicz et al. 2019



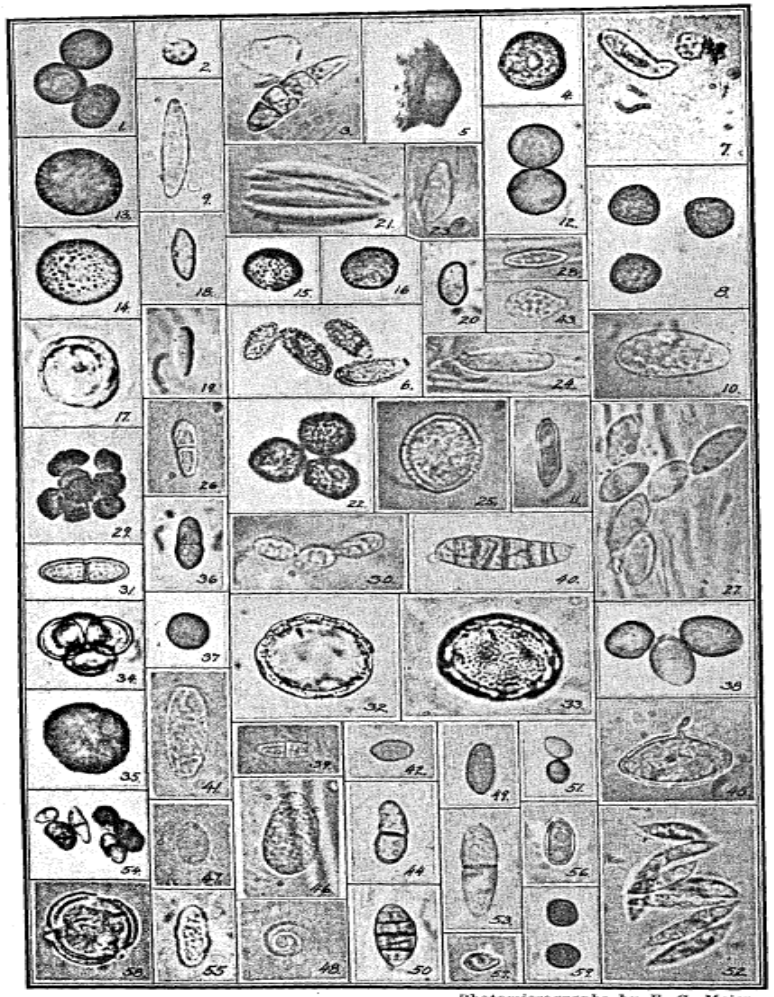






Aerobiology Pioneers

Meier and Lindbergh (1935)



Photomicrographs by F. C. Meier

FIG. 11. SOME OF THE MORE CONSPICUOUS OBJECTS FOUND ON SLIDE 9. X 660. (SEE FIGS. 2 AND 8.)

Clouds are Accessible…

Even Close to Home

AGU 100 | FALL MEETING
San Francisco, CA | 9–13 December 2019

ctory

B003

Advances in Aerobiology: Investigations and Techniques for Atmospheric Microbiology

Session ID#: 83725

Session Description:

Aerobiology is the science of life in the atmosphere. Beyond animals capable of flight, the atmosphere is host to significant microbial life, as spores, on dust particles, and within fog and cloud water. These airborne microbes have substantial regional and global impacts, affecting aerosol composition, ice and cloud nucleation, health and agriculture, and biodiversity. Advances in aerobiology are enabled by innovation in areas including sample capture (balloons, aircraft, rocketry, drones, fog collectors); sample analysis (low-biomass detection, nucleation studies, phylogenetic classification, functional genomics); and integration with remote sensing and climate and ecosystem modeling (dust trajectories, aerosol lifetimes, biodiversity, habitability). This session seeks diverse contributions covering all areas of aerobiology, including new field observations, sampling platforms or strategies, laboratory experiments, theoretical modeling, and Earth's atmosphere as an analogue for other worlds. Studies that integrate multiple types of data, or observations across spatial and temporal scales, are particularly encouraged.

Index Terms:

0305 Aerosols and particles [ATMOSPHERIC COMPOSITION AND STRUCTURE]
0426 Biosphere/atmosphere interactions [BIOGEOSCIENCES]
0452 Instruments and techniques [BIOGEOSCIENCES]
0465 Microbiology: ecology, physiology and genomics [BIOGEOSCIENCES]

Primary Convener: **Diana Gentry**, NASA Ames Research Center, Biospheric Science Branch, Moffett Field, CA, United States

Conveners: **Samantha Waters**, Universities Space Research Association, NASA Ames Research Center, Moffett Field, CA, United States and **David Joseph Smith**, NASA Ames, Mountain View, United States

Primary Liaison: **Diana Gentry**, Stanford University, Stanford, CA, United States

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- NASA Airborne Science Program
- NASA ARC Director for Research and Technology, Lawrence Livermore National Lab
- NASA Biodiversity (SMD Earth Science Division)
- NASA Space Biology Program
- NASA Astrobiology Program