Experiment 20	**Monitoring of atmospheric particles and sampling of airborne microorganisms**
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Reading	Chapter in BBOM 10th: 25.11
Objectives	Quantitative determination of particle different size classes Analysis of distribution patterns and temporal fluctuations Sampling of microbes from the atmosphere Sampling of indoor and outdoor air from selected sampling sites Use of selective solid growth media for airborne microorganisms
Background	It is known that airborne particles (e.g. dust, pollen, pathogenic organisms) can negatively influence the health. In many cases, the total number of airborne particles is correlated with biological agents. Bioaerosols are defined as aerosols (solid or liquid particles in a gas) of biological origin. These include viruses, viable organisms such as bacteria and fungi as well as products of organisms such as bacterial or fungal spores, plant parts or pollen. Usually, particle concentrations show large variations depending on sampling locations. In addition, seasonal as well as diurnal fluctuations occur. Airborne particles can easily be counted by suited equipment without the need of subsequent analytical techniques. Optical counters are based on laser light scattering. However, these counters are non-selective and cannot distinguish between biological and non-biological particles. We will use the MetOne Laser Particle Counter. Two size classes can be simultaneously recorded. Single readings are stored in the internal memory which can be downloaded to a computer and subsequently be analyzed.  Airborne biological particles are called bioaerosols. Generally, bioaerosols are generated as droplets or particles of different sizes. Air serves as a mode of transport for the dispersal of bioaerosols from one location to another. Composition and concentrations of microbes in the bioaerosol vary with the source and the dispersal in the air until deposition. Possible sources comprise fresh and marine surface waters, soils, plants, and animals. It has to be noted that infectious microorganisms can be dispersed as aerosols. Microorganisms released into the air are often single units (e.g. spores) or associated with particles in the range of 0.3 to 100µm. Transport and ultimate settling of a bioaerosol are affected by its physical properties (size, density, shape) and environmental parameters (air currents, humidity, temperature). The objective of bioaerosol sampling is the efficient removal and collection of biological particles from the air. The three principal collection methods used in quantitative bioaerosol sampling are impaction, impingement, and filtration. Impaction separates parti-

	cles from the air stream by depositing them onto solid surfaces such as adhesives or agar plates. Impingement is similar to impaction; however, the collection medium is liquid such as a buffer solution. Filtration achieves the particle separation from air stream by passage through a porous medium, e.g. a membrane filter. There is a wide variety of commercially available bioaerosol samplers. The selection of the sampler depends on a number of factors such as sampler performance, expected bioaerosol concentration, and analysis method. For our purpose, the MAS-100 Eco sampler (MBV AG, Littau) will be used. This model has been specially developed for the food and beverage industries. The instrument can be used whenever air has to be monitored. The use of standard 100 mm Petri dishes and the low initial costs of the MAS-100 Eco makes this product very attractive. 
Literature	Brandl H. et al. (2005) Generation of bioaerosols during manual mail unpacking and sorting. Journal of Applied Microbiology 99:1099-1107
www Links	http://www.aerobiology.net/resources.html http://www.mbv.ch/Luftkeimsammler.htm
Practical work	We will collect air samples from different indoor and outdoor locations.
Materials and Experimental Protocols	Operation of laser particle counter Operation of impaction sampler Demonstration of impingement sampling Demonstration of filtration sampling of air
Experiences gained	Overview on sampling of airborne particles Operation and maintenance of an air sampler (MAS-100 Eco)
Timing	120 min sampling periods
Reporting	Note in a table: group number, sample number, date, time, location, volume sampled, growth medium
Questions to be answered	What are the principles of air sampling? How is a specific sampler operated?
Outlook	Clearly, no single sampler and sampling protocol is likely to be adequate for all bioaerosols in their diverse environments. Microbial bioaerosols present special difficulties because of the potential conflicts between their efficient sampling as particles and as viable entities. Establishing performance standards for bioaerosol samplers and sampling is essential. The potential for adverse environmental and human health effects resulting from indoor and outdoor bioaerosol exposure has prompted enhanced interest in aerobiology, especially with respect to health-related incidences.