Primary biological aerosol particles (PBAP) including, but not limited to, bacteria, spores, and pollen are essential for the spread of organisms and disease in the biosphere. Numerous studies have also suggested that they may be important for atmospheric processes. Large uncertainties exist in the understanding of properties of atmospherically relevant PBAP, however, because comprehensive field measurements have been prohibitively difficult until relatively recently. In the past, most PBAP measurements were based on off-line techniques with low time resolution (hours/days) that required laborious and expensive analyses. Recent developments in real-time detection of PBAP have become increasingly available within the last decades.

Among a wide spectrum of analytical techniques that have been applied to the direct detection of atmospheric bioaerosols, laser induced fluorescence (LIF) and aerosol mass spectrometry have shown the most success. LIF techniques utilize naturally fluorescent bio-molecules either to detect the presence of PBAP in real-time (with high time and size resolution) or to pre-select particles for further analysis. Several such instruments are now commercially available, in addition to a multitude of research prototypes world-wide. Aerosol mass spectrometry has also been successfully applied to the detection of PBAP with the added capability to provide chemical information in real-time.

A brief review of important classes of physical and chemical approaches for the direct detection of biological aerosols will be given, with the focus being on LIF techniques. Examples from field applications will be shown to highlight emerging instrumental capability and technical needs.