Abstract

**TITLE:** Response of rat alveolar macrophages upon in vivo exposure to silver nanowires

**Abstract Body:** Silver nanowires (AgNWs) were instilled into the lungs of Sprague Dawley rats and macrophages were recovered 24 hrs following exposure by lavaging the lungs. The cell-nanowire interaction was investigated by cell differential assessment, histopathology, morphology imaging using scanning electron microscopy (SEM), and mechanics measurements via combined atomic force microscopy (AFM) with laser scanning confocal microscopy. Significant neutrophil and eosinophil infiltration into the broncho-alveolar lavage fluid (BALF) and epithelial sloughing were observed, along with frustrated macrophages and giant foreign body macrophages. PVP coated silver nanowires 20 μm long and 40 nm in diameter were characterized using AFM and confocal microscopy, revealing characteristic fluorescence. Mechanical properties of cells affected by silver nanowires (AgNW) have been assessed using AFM-based single-cell compression. The comparison of the force profiles revealed a substantial softening of the cells, which indicates membrane and cytoskeletal perturbations. The intracellular AgNW were visualized using confocal microscopy and SEM, revealing that nanowires pierce the cells, as opposed to being on top of the membrane. Collectively, the impacts of AgNWs on macrophage are both chemical and mechanical in nature. This investigation indicates that multi-modal imaging tools are important towards understanding of nanowire-cell interactions.

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Fig. 1 Force profiles of control (blue) versus exposed (red) cells. Insets: Schematic diagram of SSC and confocal image of a cell pierced by AgNWs.
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