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Role of Fiber Length on Phagocytosis & Inflammatory Response

LEONID TURKEVICH, CEMB/DART/NIOSH/CDC, CARAHLINE STARK, JULIE CHAMPION, Chemical & Biomolecular Engineering/Georgia Institute of Technology — Asbestos fibers have long been associated with lung cancer death. The inability of immune cells (e.g. macrophages) to effectively remove asbestos leads to chronic inflammation and disease. This study examines the role of fiber length on toxicity at the cellular level using model glass fibers. A major challenge is obtaining single diameter fibers but differing in length. Samples of 1 micron diameter fibers with different length distributions were prepared: short fibers (less than 15 microns) by aggressive crushing, and long fibers (longer than 15 microns) by successive sedimentation. Time-lapse video microscopy monitored the interaction of MH-S murine alveolar macrophages with the fibers: short fibers were easily internalized by the macrophages, but long fibers resisted internalization over many hours. Production of $\text{TNF-}\alpha$ (tumor necrosis factor alpha), a general inflammatory secreted cytokine, and Cox-2 (cyclo-oxygenase-2), an enzyme that produces radicals, each exhibited a dose-dependence that was greater for long than for short fibers. These results corroborate the importance of fiber length in both physical and biochemical cell response and support epidemiological observations of higher toxicity for longer fibers.

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