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Magnetic nanodrug delivery through the mucus layer of air-liquid interface cultured primary normal human tracheobronchial epithelial cells.[1] KATHRIN SPENDIER, EVANGELOS ECONOMOU, SIMON MARINELLI, University of Colorado at Colorado Springs, HONG CHU, National Jewish Health, ZBIGNIEW CELINSKI, University of Colorado at Colorado Springs — In several prominent human lung diseases, such as asthma, patients produce a thickened mucosal fluid, irritating and inflaming the underlying tissue that progresses the condition. Many current drug therapies prove ineffective due to the inability to penetrate this thickened mucosal layer. In this study, superparamagnetic Fe_3O_4 and highly anisotropic $BaFe_{12}O_{19}$ nanoparticles were surface-engineered for the purpose of transporting anti-mucin medicine through the mucus layer of air-liquid interface cultured primary normal human tracheobronchial epithelial (NHTE) cells via magnetic field gradient. Using wet planetary ball milling, surfactant-coated $BaFe_{12}O_{19}$ nanoparticles (BaNPs) of 60 nm in diameter were prepared in water. BaNPs and conventional 30 nm surfactant-coated Fe_3O_4 nanoparticles (FeNPs) were then encased in a polymer (PLGA) loaded with dexamethasone (Dex) and tagged for imaging. Both PLGA-Dex coated BaNPs and FeNPs were added on top of an approximately 100 micrometer thick mucus layer of air-liquid interface cultured NHTE cells. Within 30 minutes, PLGA-Dex coated FeNPs and BaNPs were pulled successfully through the mucus layer by a permanent neodymium magnet for the first time. The penetration time of the nanomedicine was monitored using confocal microscopy.

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