DAGSI Research Topic

1. **Research Title:** Effects of Inhaled Particles on Lung Surfactant Function: Impact on Airmen Readiness Engaged in High-demand, High-impact Mission Tasks

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**
Molecular Biology/Pharmacology/Bioengineering/Computer Science (BS, MS or PhD level)

4. **Objectives:** 1) Assess the interactions between lung surfactants and particles/mixture of chemicals relevant to Air Force occupational settings. 2) Assess the effects of diminished surfactant function on cell surface receptors and cell surface structure using a respiratory tissue model. 3) Build computational based model using artificial intelligence & machine learning tools capable of predicting respiratory health effects of diminished lung surfactant function on Airmen readiness engaged in high-demand, high-impact mission tasks.

5. **Description:**
Airmen constantly endure an evolving spectrum of operational stress scenarios that are vital to the continued success and achievement of the Air Force mission directives. The exposure to operational stress factors (aerosol particles & chemicals) is linked to critical medical attributes that impact the Airmen readiness engaged in high-demand, high-impact mission tasks. Lung surfactant (LS), also called pulmonary surfactant, is a phospholipid-protein complex secreted by the type II alveolar epithelial cells that combines with water in the lungs to create a film at the air-liquid interface. LS serves as a protective barrier to prevent absorption of harmful particles into the bloodstream while simultaneously reducing surface tension to near zero. This reduction in surface tension stabilizes alveoli against collapse by reducing the amount of effort required to inflate the lungs during breathing. Additionally, reduced surface tension increases breathing efficiency by reducing alveolar pressure and maximizing surface area for gas exchange. Inhalation of aerosols that interfere with LS may diminish normal function and contribute to the onset of collapsed alveoli, acute respiratory distress syndrome, tissue damage, and reduced Airmen readiness & performance. The goal of this project is to implement a novel method that simulates diminished lung surfactant

function and assesses respiratory health effects of particles through biophysical (cell-free) and biochemical (*in vitro*) endpoints.

6. **Research Classification/Restrictions:** NA

7. **Eligible Research Institutions:**

☒ **DAGSI** (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati, and all other Ohio Universities)

☒ **Topic can be submitted for public release**

☐ **AFIT** (only)

☐ **USAFA** (only)

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