**Introduction**

This research was conducted to identify and quantify the health effects of inhaling particulate matter on the pulmonary and cardiovascular systems following acute and chronic exposure to Wildland fire smoke (WLFS) and e-cig aerosol.

When smoke enters the trachea and further into the lungs, the body reacts with an immune response from aerosols. It is unclear how the inhalation of WLFS and e-cig vapor directly impacts the health of the cardiovascular and pulmonary system after acute and chronic exposure.

This research will measure and help better understand break down of cardiopulmonary dysfunction from Wildland fire and e-cig smoke.

In the WLFS research project, the effects of inhaling WLFS will be analyzed with and without a common form of Personal Protective Equipment (PPE) used in the field today, for example bandanas and dust masks.

Similarly, in the e-cig research project, the effects of inhaling aerosol will be analyzed in contrast to traditional cigarettes and no smoke inhalation.

**Materials & Methodology**

**Wildland Fire Smoke Exposure**
- Generate Wildland Smoke.
- Construct Mouse exposure Chamber.
- Expose ApoE mice.
- Collect particle data.
- Collect blood and tissue samples.
- Analysis of cardiopulmonary mechanics.
- Analysis of inflammatory response.
- Translate data from mouse to human.

**E-Cigarette Exposure**
- Generate e-cig aerosol.
- Assemble exposure chamber for e-cig cigarettes and no smoke.
- Expose ApoE mice.
- Collect particle data.
- Collect blood and tissue samples.
- Analysis of cardiopulmonary mechanics.
- Analysis of inflammatory response.
- Translate data from mouse to human.

**Particle Measurements**

This graph displays the accuracy of the exposures. As the number of cigarettes increases, the total mass increase linearly.

This graph displays the concentration of smoke the mice are exposed to as a function of time.

**Motivation**

- Inhaling particle matter in wildland smoke has been linked to numerous respiratory illnesses amongst the Wildland firefighter (WLF) community, for example Chronic Obstructive Pulmonary Disease (COPD) and stiffening of central arteries.

- Wildland firefighters are not required to wear respiratory PPE, unlike structural firefighters. (Fig. A)

- E-cigs generate an aerosol from a liquid solution that contains harmful constituents. (Fig. A)

- E-cig is advertised as a “healthier” alternative to cigarettes however minimal research has been done on E-Cig health effects.

**Contributions**

- Assembled Wildland fire smoke generating machine. (Fig.1)
- Assembled electrical circuit for smoke machine and an atomizer. (Fig.2)
- Participated in mouse acclimation and cigarette exposures for particulate matter data collection. (Fig. 3 & 4)
- Redesigned MDP attachment for more precise particulate concentration data using SolidWorks. (Fig. 6)
- Designed a stand used for lung mechanics and dissections using SolidWorks. (Fig.5)

**Conclusion**

Smoke inhalation is linked to various diseases and health repercussions. In vivo mouse models are an essential tool for better understanding how various forms of smoke inhalation impacts health. To best conduct smoke exposure studies, it is essential to develop a pipeline which accurately and precisely exposes mice to particulate matter.

During this R.E.U experience I used my hands-on mechanical knowledge and Computer aided drafting skills to ultimately help these research projects generate accurate data during experiments and help reach project milestones.

The goal of this research is to:
- Reveal the causative link between smoke inhalation and disease development.
- Understand the long-term health problems after acute and chronic exposure to WLFS and E-cig.
- Offer a safe PPE protocol for WLFF.

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**References**

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