**Impact of wildfire smoke exposure on SARS-CoV-2 immunity as predicted by Machine Intelligence Learning Optimizer (MILO)**

SARS-CoV-2 is the virus responsible for the COVID-19 pandemic and has led to 500 million infections and 6.2 million deaths worldwide. In August 2020, during heavy wildfire season in the Sacramento area, a cohort of Pfizer BioNTech BNT162b2 COVID-19 mRNA vaccine trial subjects were recruited in an investigation to study the role of the innate immune natural killer (NK) cells and the immunoprotective lung collectin, surfactant protein D (SP-D), in vaccine-induced immunity against SARS-CoV-2. My study found that a subset of NK cells, the CD56bright NK cells, increased in the blood upon vaccination, but only when vaccination with BNT162b2 occurred under clean air conditions. Wildfire smoke not only reversed this effect, but it also induced inflammatory changes in blood cells and leakage of SP-D to the serum that can be reflective of lung damage. I hypothesize that vaccination increases CD56bright NK cells in association with high production of anti-SARS-CoV-2 neutralizing antibodies. Wildfire smoke suppresses vaccine effects on circulating NK cells, releases SP-D into the blood, and elicits systemic pro-inflammatory cellular and molecular signatures that is predictive of impaired anti-SARS-CoV-2 immunity. Using a machine learning algorithm (MILO), I would like to investigate if CD56bright NK cell counts in the peripheral blood predict production of anti-SARS-CoV-2 Spike (S) neutralizing antibodies upon vaccination, as well as to determine if wildfire smoke induced SP-D leakage and cytokine release to the circulation predict impaired immune protection to SARS-CoV-2.