

Integrated multi-omics approach to detect early lung cancer, Principal Investigator, Karen Kelly, Ph.D. (20PT-0034)

Lung cancer has been the leading cause of cancer deaths for both men and women in the United States for more than two decades. The major reason for this devastating statistic is the lack of an approved test to detect small lung cancers that can be cured by surgical removal. A few months ago, the results from the largest screening and early detection study ever conducted in the US revealed that a sensitive radiology test called a CT scan successfully found small lung tumors in heavy, current or former smokers reduced the death rate from lung cancer by 20%. However, the CT screening study had limitations and it should be viewed as a first step toward reducing lung cancer deaths. The next step is to develop additional simple test(s) that can identify subjects for whom CT screening will be most beneficial. Currently, 90 million current and former smokers are considered at high risk for lung cancer but only 222,520 new cases of lung cancer are diagnosed every year. Biological clues (biomarkers) that can identify the highest risk individuals for which an active intervention, such as the surgical removal of a tiny lung cancer or frequent monitoring of the patient with CT scans, is aggressively being pursued. In addition, a proven biomarker test would give us an opportunity to expand prevention strategies beyond smoking cessation programs.

Blood-based biomarkers are a prime target for evaluation because blood is routinely obtained in primary care clinics and is associated with minimal risk. Most research efforts have focused on identifying genes (genomics) and proteins (proteomics) secreted by the tumor into the blood. To date, studying genes and proteins have had limited success. One reason for this could be that genes and proteins provide only a small snapshot of a tumor's presence in the body. Newer, sophisticated research tools have made it possible to study a broader range of substances such as sugars (glycomics), fats (lipidomics) and chemicals (metabolomics) in normal and diseased states. A large amount of data has already accumulated demonstrating differences in sugars, fats, and chemicals in cancer patients compared to healthy volunteers. Researchers at UC Davis are leaders in this specialized field. They have made significant contributions to our understanding of the association of these substances and several cancers including colon, ovarian, breast, and kidney. Together, with the UC Davis internationally recognized multidisciplinary lung cancer clinical program, this research team of physicians and scientists have produced preliminary information showing that different sugar, fat, and chemical patterns are in the blood of patients with lung cancer compared to those patients without lung cancer. We hypothesize that an optimal test for screening and early detection of lung cancer will contain biomarkers from these different groups of substances. This proposal seeks to build on our preliminary data by 1) continuing to discover sugars, fats and chemicals that can consistently distinguish lung cancer from individuals without lung cancer 2) conducting extensive testing of promising biomarkers in specific subpopulations of patients with lung cancer (females versus males, current versus former smokers, early versus late disease), patients with non-cancer lung disease and current and former smokers without cancer to find the optimal set of biomarkers and 3) testing blood samples collected prior to the diagnosis (prediagnostic) of lung cancer for the presence of our optimal biomarker set. Upon successfully completion of this grant we will have identified a unique set of biomarkers that can be found in the blood of patients before their diagnosis of lung cancer. To confirm our findings we plan to evaluate a large number of prediagnostic samples from patients throughout the United States.