Immunopeptidomics of Non-small Cell Lung Carcinomas (NSCLC) for the Discovery and Validation of Novel Peptides for Targeted Immunotherapy

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Non-small cell lung carcinoma (NSCLC), accounting for the majority of lung cancer cases, has become a high-studied topic in the field of immunotherapeutics. While there are treatment options for NSCLC, many have a limited clinical benefit. An alternative approach to immunotherapeutic discovery for NSCLC consists of identifying NSCLC peptides which underwent proteolytic processing followed by presentation on human leukocyte antigen (HLA) class I molecules. The objective of this dual-step research was to use mass spectrometry to identify and quantify the cancer-specific HLA-associated peptides in NSCLC for targeted immunotherapeutic development, specifically with peptides originating from either cancer-testis (CT) antigens or neoantigens, two classes of cancer-rejection antigens. After receiving the raw data from 55 squamous cell lung carcinoma samples and 36 lung adenocarcinoma samples, I then utilized PEAKS®? Studio X (BSI) to translate raw mass-spectrometry data and further data-mining R and Python scripts for analysis and identification of the HLA-associated epitopes. 101 peptides and 77 peptides from the CT antigens in squamous cell lung carcinoma and lung adenocarcinoma samples were identified, respectively. This includes the novel HLA-A24-specific RYGNVSHF(321-328), HLA-A02-specific KIQEILTQV(552-560), and 44 peptides from the MAGE and PRAME antigen families. Also, I identified 711 and 1171 unique, possible neoantigen peptides through DNA and RNA-sequencing, respectively, along with 14 peptides from hotspots, a subset of neoantigens. They all may be viable options for treatment and have not been identified in any normal sample data thus far.

Awards Won:
Fourth Award of $500
American Committee for the Weizmann Institute of Science: Two finalists will be selected to receive a scholarship to attend the Bessie Lawrence International Summer Science Institute, which will be held virtually for 2021.