Title: Spectroscopy-based method for study on cells senescence

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Abstract

Immunosenescence is an age-related change in immune system. This condition lead to the decline in immune system and characterized by decreased immune response resulting in susceptibility to infections, decreased vaccination response, increased expression of pro-inflammatory cytokines which contributes to inflammation-related diseased, increased autoimmune events, and an increased risk of age-related diseases. These age-related changes occur in innate and adaptive immune cells, altering their numbers and functions. This conditions led to rise of pathogenic and immunosenescent cells. One of the important immune cells is CD4+ T cells, due to its crucial function to stimulate other immune cells such as macrophages, B cells, and CD8+ T cells. Furthermore, WHO recognize ageing at the biological level can lead to gradual decrease in physical and mental capacity, increasing risk of disease and death. Detection of immunosenescence is important for disease risk management. It could help clinicians to adjust the specific healthcare on the elder patient based on their immune status. Immunosenescent commonly are identified by flow cytometry using the related markers and throughout literature. Flow cytometry is a powerful technique and has been utilized to assess the circulating immunophenotype in COVID-19, vasculitis, or healthy individual. However, some challenges arise in using flow cytometry, such as the need of expertise in sample preparation and instrument operation, instrument accessibility, and subjective data interpretation. Therefore, other sample source and methods that is easy to perform, rapid and cost-effective for detection of immunosenescence need to be explored.

In this seminar, the use of spectroscopy-based method, FTIR and Raman will be explored. In summary, FTIR combined with advanced machine learning algorithms allows differentiating the elderly with a low percentage (LP) and a high percentage (HP) of pathogenic CD4+ T cells. The biomolecular changes could be observed by using FTIR. The classification models generated by the NN algorithm resulted in the best performance with an accuracy of 100% in serum, 95% in exosomes, and 97% in HDL. Meanwhile the Raman spectroscopy, combined with AFM-based quantitative nanomechanical techniques and surface potential microscopy can be used for the high-resolution and multi-parameter characterization of SnC-derived sEVs. These 3 method can be further used to develop noninvasive, safe, and sensitive analytical methods to scrutinize SnC-derived sEVs in cell culture, as well as in clinical samples such as plasma from patients with age-related diseases.

References:

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