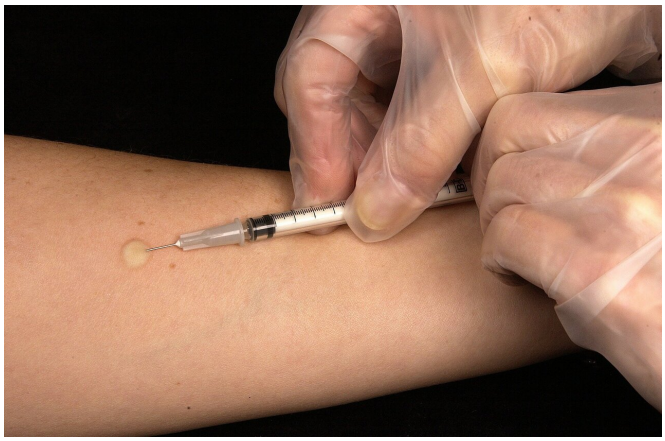
Tuberculosis vaccine could assist future COVID-19 vaccine development

13 January 2022, by Laurie Fickman



Credit: Pixabay/CC0 Public Domain

Despite unprecedented efforts to develop COVID-19 vaccines in record time amid the global pandemic, SARS-CoV-2 continues to spread rapidly with the emergence of new variants, such as Delta and Omicron, making the development of new therapeutic strategies critically important.

Preliminary studies early in the pandemic found evidence that countries with Bacillus Calmette-Guérin (BCG) vaccination programs, which fights tuberculosis, could be associated with a reduced number and/or severity of COVID-19 cases. While clinical trials are ongoing to further investigate, a University of Houston computational biology researcher is reporting cross reaction between the two illnesses that might help explain what could be driving immunity brought on by the BCG vaccination.

"The protection against SARS-CoV-2 induced by BCG vaccination may be mediated by cross-reactive T cell lymphocytes, which recognize peptides displayed by class I Human Leukocyte Antigens (HLA-I) on the surface of infected cells," reports Dinler Amaral Antunes, assistant professor of computational biology and a corresponding author of the work published in the journal *Frontiers in Immunology*.

The researchers from UH, Pontifical Catholic University of Rio Grande do Sul and Rice University implemented a large-scale computational screening to identify potential targets with biochemical similarities between the two illnesses.

T cell lymphocytes develop from stem cells and help protect the body from infection. T cell responses to SARS-CoV-2 are vital for helping resolve viral infections and protecting against reinfection by providing long-lasting immunity. Peptides are chains of amino acids connected to one another that can be derived from proteins of the virus, as well as from proteins of the host. HLAs are receptors that display these peptides to the immune system.

The research team screened over 13.5 million possible cross-reactive peptide pairs from BCG and SARS-CoV-2. The analysis produced a large dataset of cross-reactive clusters, which ultimately led to the identification of 40 peptide pairs with potential cross-reactivity with BCG peptides.

The top 40 list includes SARS-CoV-2-derived peptides GEAANFCAL, GEVITFDNL and FIAGLIAIV which have been independently shown to induce T cell response, Interferon Gamma (INF-?) production and lymphocyte proliferation in COVID-19 patients. INF-? is a critical component of immunity against viral and some bacterial infections.

"In addition, multiple peptides from our top 40 list have been reported to induce T cell activation in recent studies analyzing aspects of cellular immunity in COVID-19 patients," said Antunes. "The development of peptide-based vaccines targeting coronaviruses and presenting cross-reactivity with existing pools of memory T cells,

could be an interesting strategy to complement and extend the protection conferred by existing COVID-19 vaccines."

The research team includes co-author André Fonseca, a postdoctoral researcher working in the Antunes lab; Ana Paula D. De Souza, Tiago C. Ferreto, Renata F. Tarabini, Rafael Bele and Felipe Rubin of Pontifical Catholic University of Rio Grande do Sul, Brazil; and Lydia E. Kavraki, Mauricio Menegatti Rigo of Rice University.

This study is part of a special topic collection at *Frontiers in Immunology*, focused on T-cell cross-reactivity. Antunes is one of the guest editors of this collection.

More information: Renata Fioravanti Tarabini et al, Large-Scale Structure-Based Screening of Potential T Cell Cross-Reactivities Involving Peptide-Targets From BCG Vaccine and SARS-CoV-2, *Frontiers in Immunology* (2022). DOI: 10.3389/fimmu.2021.812176