Development of a low-cost, domestic recombinant vaccine using the silkworm insect modality

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In order to establish a domestic vaccine production platform with a view to social implementation, for which there are high expectations for public research institutions, Kyushu university (KU) is working to establish an innovative, purely domestic vaccine research platform that is different from other universities by creating comprehensive knowledge that leverages KU's strengths, such as the world's top silkworm bioresource and insect factory as vaccine production modalities, and multiomics research. In this research, targeting SARS2 coronavirus and norovirus vaccines, we will establish a platform for large-scale commercial production of recombinant proteins using insect factory, construct a rational vaccine design system and evaluate their function as vaccines, including animal infection experiments, at the newly expanded ABSL3 facility.

This will establish a system that allows all vaccine kinetic analyses using various model experimental animals to be completed within KU.

In addition, through close collaboration with the National Institute of Biomedical Innovation (adjuvant selection system), a KU start-up KAICO (GMP drug discovery and pre-clinical testing), and Souseikai Medical Corporation (Phase I clinical trials), we plan to complete up to Phase I clinical trials of the targeted vaccine and establish a system that can respond immediately to the next pandemic.

With regard to persistence of vaccine efficacy, adverse reactions, and sequelae, which are one of the biggest concerns of this new coronavirus vaccine, we are challenging to predict in a short period of time by using world-leading multiomics analysis for these evaluations, which previously required a long study period. This strategy of high depth omics analysis is also expected to be effective in predicting severity and sequelae during viral infection.

The greatest feature of this silkworm vaccine modality is its ability to rapid and stable supply of vaccine candidates with complex higher-order structures at low cost, and can mass produce purely domestic vaccines using only domestic resources and intellectual property. Vaccines for SARS2 coronavirus and norovirus produced with this modality have shown that they can produce large quantities of antigens with high neutralizing antibody induction capacity, making them extremely versatile.

Furthermore, since these vaccines are recombinant protein vaccines, it is possible to enhance the vaccine function by modifying the vaccine antigen protein, produce multivalent vaccines, and freely select various administration methods in the future, such as oral or transmucosal administration.