Research team develops vaccine platform applicable to viruses

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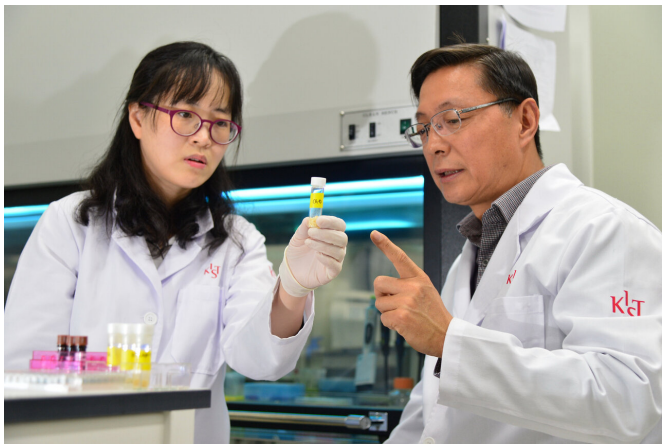
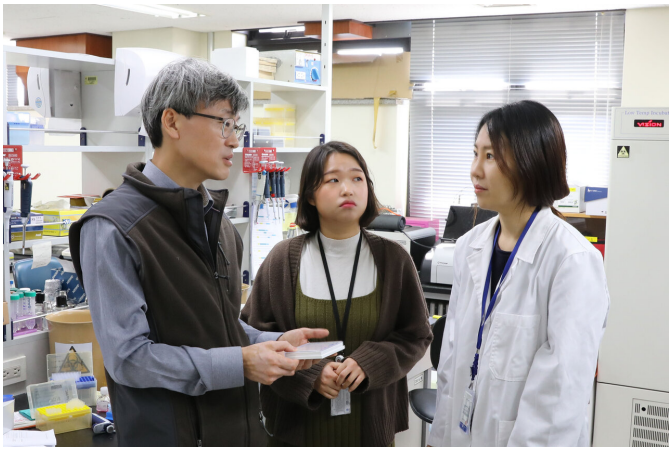


Dr. Keum Gyo-chang(right) and Dr. Bang Eun-kyoung(left) from the KIST's Center for Neuro-Medicine are discussing the efficacy of RNA stabilizer containing zinc complex. Credit: Korea Institute of Science and Technology (KIST)

MERS, which struck South Korea in a 2015 outbreak, was caused by a coronavirus, the same family of viruses that is responsible for COVID-19. Recently, a Korean research team announced that it had developed a new vaccine platform using RNA-based adjuvants for the MERS coronavirus (MERS-CoV). The research team successfully conducted an experiment on nonhuman primates. It is expected that the new vaccine platform will soon be applicable to the development of a COVID-19 vaccine, an urgent global health priority.

The Korea Institute of Science and Technology (KIST) recently released the results of the joint research on the RNA-based vaccine platform for MERS-CoV, conducted by a research team led by Dr. Keum Gyo-chang and Dr. Bang Eun-kyoung from the KIST's Center for Neuro-Medicine and a research team led by Professor Nam Jae-Hwan from the Catholic University of Korea (CUK, President Won Jong-chul). The vaccine platform uses RNA as an immunostimulatory agent known as an adjuvant, and consists of compounds that maintain the stability of the RNA and the spike protein that the virus uses to invade the host cell. The new vaccine platform is expected to be used in the development of a vaccine for the COVID-19 virus, which is also a type of coronavirus.

Recently, many protein-based vaccines, which are considered to be quite safe, have been developed. However, protein-based vaccines induce a weak immune response in antibody-producing cells. This requires the use of a highly stable adjuvant for a more balanced immune response.



Professor Nam Jae-Hwan(left), Dr. Hyo-Jung Park(right), Researcher Hye Won Kwak(middle) from the Catholic University of Korea (CUK) are discussing the immune effects of T-cells of vaccines containing RNA. Credit: Korea Institute of Science and Technology (KIST), Catholic University of Korea (CUK)

The joint research team mixed the RNA of the cricket paralysis virus, an adjuvant developed by the CUK research team, and an RNA stabilizer containing zinc complex, developed by the KIST

research team. A vaccine was created using the mixture, along with the spike protein of the MERS-CoV, and administered to a group of mice. After just one inoculation, the vaccine was shown to have adequate protective efficacy (100% protective efficacy against lethal doses of the virus). The MERS-CoV infection was also suppressed through the induction of high neutralizing antibodies (PRNT 80 titer > 1:2,560) when the same vaccine was administered to macaque monkeys, which are nonhuman primates. RNA adjuvant and stabilizer mixed together can be applied to most vaccine types, including protein-based vaccines and inactivated vaccines, meaning that they have a wide range of potential uses.

Dr. Song Man-ki's research team at the International Vaccine Institute provided the coronavirus spike protein. For the research, Professor Lee Sang-myeong's research team at Chonbuk National University measured the amount of antibodies (neutralizing-antibody values) and conducted a virus challenge experiment, and Dr. Hong Jung-joo's research team at the National Primate Research Center, which is part of the Korea Research Institute of Bioscience and Biotechnology, investigated the immunity of nonhuman primates such as monkeys.

Dr. Keum Gyo-chang from KIST said, "This RNA adjuvant formulated protein vaccine, which has shown efficacy against the MERS virus, has the advantage of rapid application to the development of a vaccine for COVID-19, which is caused by the same type of virus that causes MERS." Professor Nam Jae-Hwan from CUK further explained, "The nucleic acid (DNA or RNA)-based vaccines that have recently been reported, have not previously been produced as vaccine products and have not gone through large-scale clinical trials. In contrast, protein-based vaccines are widely used. In this study, we added RNA as adjuvant to protein vaccine whose safety has already been proven. We expect that this new vaccine platform will enable the development of a safe vaccine."

Currently, the CUK research team is developing a COVID-19 vaccine and a vaccine for "severe fever with thrombocytopenia syndrome" (with research funds provided by Samkwang Labtree), using the vaccine platform. The research team has formed a consortium with SK Bioscience to manage the development of a COVID-19 vaccine.

More information: Hyo-Jung Park et al, Nanoformulated ssRNA-based Adjuvant with a Coordinative Amphiphile as an Effective Stabilizer to Induce a Humoral Immune Response by Activation of Antigen-presenting Cells, *Angewandte Chemie International Edition* (2020). DOI: 10.1002/anie.202002979

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