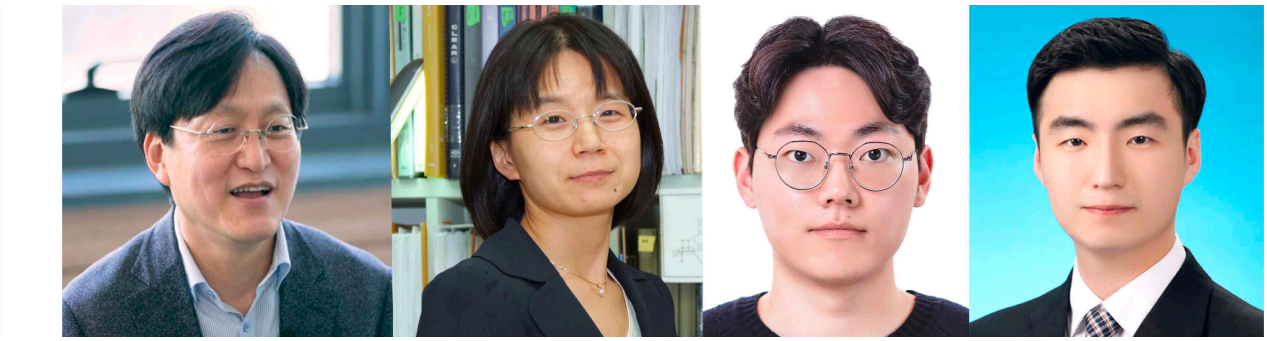
# GIST-KRICT (Korea Research Institute of Chemical Technology) Develops Candidate Substance for Vaccine Adjuvant That Enhances Immune Effect

- Professor Jin Hee Ahn (GIST) and Dr. Meehyein Kim (KRICT) joint research team discovered TLR7 agonist with 224 times higher efficacy than toll-like receptor TLR8... Improving vaccine efficacy by activating immune activity
- Expected to open new possibilities for treating various diseases such as viral infections and cancer as a vaccine adjuvant and powerful immune modulator... Published in the international academic journal 「Journal of Medicinal Chemistry」



▲ (From left) Professor Jin Hee Ahn of GIST Department of Chemistry (CEO of JD Bioscience), Dr. Meehyein Kim of KRICT, master's student Morgan Kim of GIST Department of Chemistry, and PhD student Kyungseob Noh of KRICT

The Gwangju Institute of Science and Technology (GIST, President Kichul Lim) announced that a joint research team led by Professor Jin Hee Ahn of the Department of Chemistry and Dr. Meehyein Kim of the Korea Research Institute of Chemical Technology (KRICT) developed a candidate vaccine adjuvant that significantly improves the efficacy of vaccines.

It is expected that the results of this study can be utilized as a new vaccine adjuvant candidate for the treatment of diseases caused by viral infections such as influenza or coronavirus.

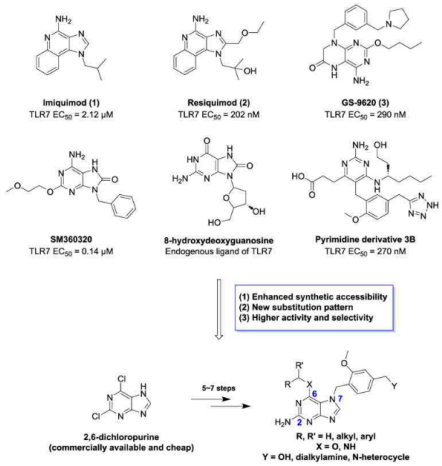
TLRs (Toll-like receptors), which are membrane proteins that play an important role in innate immunity, are known from TLR1 to TLR10 in humans. Among them, 'TLR7/8 (Toll-like receptor 7/8)' agonist is a versatile immune stimulant that can treat various diseases such as viral infections, autoimmune diseases, and cancer.

Therefore, toll-like receptor (TLR7/8) agonists are being developed as one of the immune enhancement methods that can increase innate immunity, but they have limitations in immunotoxicity and formulation. Because TLR7 and TLR8 have significant differences in the immune stimulation process and response over time, it is necessary to develop an agent that selectively activates each receptor. However, due to their structural similarity, development is very difficult.

Based on basic research, the research team sought to develop a selective agonist that only acts on TLR7. As a result, we succeeded in discovering a TLR7 agonist with a half maximum effective concentration ($EC_{50}$)* of 17.53 nM for TLR7, which is 224 times higher than the effect on TLR8.

* Half maximum effective concentration ($EC_{50}$): This refers to the amount of drug needed to produce half the maximum drug effect. The lower the half-maximum effective concentration value, the smaller the

amount of drug required to achieve the same medicinal effect. Even for drugs of the same type, the lower the $EC_{50}$ value, the more effective the drug is and the less side effects such as toxicity.




▲ Development of new vaccine adjuvant candidates: Development of new candidate materials with higher efficacy and selectivity than existing TLR7 agonists. A material with $EC_{50}$ = 17.53 nM, which is more powerful than existing materials and has improved TLR7-selectivity, was synthesized. A new material was derived through economical and efficient synthesis using an economically advantageous and easy-to-obtain molecule called 2,6-dichloropurine as a starting material.

The agent effectively stimulated the secretion of pro-inflammatory cytokines from macrophages in a mouse model and enhanced the efficacy of a nasal vaccine against influenza A virus in vivo.

In addition, as a result of the evaluation of humoral and mucosal antibody titers, this compound was confirmed to have a protective effect against homologous and heterologous influenza virus infections by increasing the levels of immunoglobulin (IgG) and immunoglobulin A (IgA).

These findings suggest that the TLR7 agonist developed by the research team is promising as a vaccine adjuvant to prevent viral infections and is likely to have long-term activity as a powerful immunomodulator for treating immunosuppressive diseases.

Professor Jin Hee Ahn said, "The results of this study suggest that the TLR7 agonist is promising as a vaccine adjuvant to prevent viral infections and has the potential to have long-term activity as a powerful immunomodulator to treat immunosuppressive diseases. It is expected to open new possibilities for treating various diseases such as viral infections and cancer."

This research, conducted by GIST Professor Jin Hee Ahn (corresponding author), KRICT Dr. Meehyein Kim (corresponding author), and students Morgan Kim (GIST) and Kyungseob Noh (KRICT), was conducted with support from the National Research Foundation of Korea and the Korea Health Industry Development Institute and was published on May 24 in the 'Journal of Medicinal Chemistry', a prestigious international journal in the field of medicinal chemistry.

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