International Vaccine Design Center

Division of Human Immunology (Human Immune-Profiling Team)

ヒト免疫プロファイリング系・ヒト免疫学分野

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Summary of Activity

The laboratory is consisted of three groups working on vaccine, immunometabolism and B cell immunology lead by Ken Ishii, Noriko Toyama-Sorimachi and Takeshi Inoue, respectively. We aim to understand why and how our immune system responds to infection and other immunological disorders by conducting human immune-profiling.

1. Supporting research in response to Public Health Emergency Declaration for Mpox

To establish the research infrastructure necessary for the success of the 100-Day Mission, we achieved inter-project collaboration between the drug discovery and life science research platform BINDS, where Sorimachi serves as Program Officer, and SCARDA, thereby establishing a framework for accelerated research collaboration during infectious disease pandemics. Leveraging this foundation, we obtained monkeypox (MPXV) antigen proteins. This enabled the creation of specific antibodies against MPXV antigens, and with corporate cooperation, we successfully developed a prototype MPXV test kit.

We also evaluated the immunogenicity of LC16m8, an attenuated vaccinia virus strain which was initially developed in Japan for smallpox and approved for MPXV in 2022. Previous studies demonstrated the efficacy of LC16m8 against MPXV in non-human primates, establishing it as a key medical countermeasure. However, these studies primarily focused on viral load reduction and survival, providing limited insight into specific antigenic targets, cellular immune responses, and immunogenicity across MPXV clades, particularly the outbreak-associated clade Ib. In addition, LC16m8 efficacy in a mouse model remains undetermined. Using three genetically distinct mouse strains, we confirmed that LC16m8 induced selective antibodies against key MPXV antigens and revealed differential antigen immunogenicity, providing insights for serological diagnostics and vaccine optimization. In humans, LC16m8 enhanced neutralizing antibodies against multiple MPXV clades, suggesting broad protection. In cynomolgus monkeys, systemic administration caused localized pox lesions without significantly affecting weight, temperature, or hematological parameters. These results highlight the effectiveness and viability of LC16m8 as a safe and scalable choice for mpox vaccination. Furthermore, the comprehensive, cross-species analysis used in this study can serve as a model for developing next-generation vaccines against other poxviruses and emerging pathogens. This could potentially shorten the time it takes to respond to outbreaks, obtain regulatory approvals, and administer widespread public inoculations (Kobiyama K. et al., ***EBioMedicine***, 2025).

2. Achieving Academic Drug Discovery and Successfully Licensing to Companies

We have advanced academic drug discovery targeting intractable diseases we independently identified. We successfully licensed a major pharmaceutical lead compound to a global mega-pharma. Furthermore, we have recently identified a new drug target that could prevent individual death caused by acute respiratory distress syndrome and are advancing reseach to elucidate the mechanism of action. We also started international joint research with Friedrich Alexander University Erlangen-Nuremberg in Germany and shared information with Stanford University's drug discovery platform SPARK.

Publications

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