

International Vaccine Design Center

Division of Systems Immunology (Human Immune-Profiling Team)

ヒト免疫プロファイリング系・数理免疫学分野

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The aim of this laboratory is to launch an interdisciplinary research network to “quantitatively” understand the behaviors of pathogens and the immune reaction against pathogen infection. Our study will connect microbiology and immunology, which will lead to the development of novel vaccines in the future.

1. Understanding the evolution of SARS-CoV-2

Yu Kaku, Keiya Uriu, Yusuke Kosugi, Shigeru Fujita, Luo Chen, Jarel Elgin Tolentino, Lin Pan, Arnon Plianchaisuk, Ziyi Guo, Alfredo Amolong Hinay, Jr., Kaoru Usui, Wilaiporn Saikruang, Wenye Li, Kaho Okumura, Naoko Misawa, Mai Suganami, Adam Patrick Strange, Naomi Ohsumi, Shiho Tanaka, Mika Chiba, Ryo Yoshimura, Kyoko Yasuda, Keiko Iida, Jumpei Ito, Kei Sato.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a causative agent of coronavirus disease 2019 (COVID-19). SARS-CoV-2 emerged at the

end of 2019 and has spread all over the world. Since then, more than 770 million people have been infected with this virus and more than 7 million people have died of COVID-19, meaning that COVID-19 is ongoing pandemic and a most urgent and crucial problem in the current human society. To proceed and accelerate COVID-19-related researches in Japan, we launched a consortium, called “The Genotype to Phenotype Japan (G2P-Japan) Consortium” in January 2021. As of December 2023, more than 10 principal investigators participate in this consortium and proceed fruitful collaboration. We aim to elucidate the virological characteristics of the SARS-CoV-2 variants continuously emerging in the world.

Publications

Keiya Uriu, Jumpei Ito, Jiri Zahradnik, Shigeru Fujita, Yusuke Kosugi, Gideon Schreiber, Genotype to Phenotype Japan (G2P-Japan) Consortium, Kei Sato. Enhanced Transmissibility, Infectivity, and Immune Resistance of the SARS-CoV-2 Omicron XBB.1.5 Variant. **Lancet Infectious Diseases** 23(3): 280–81 (2023).
Shiho Torii, Kwang Su Kim, Jun Koseki, Rigel Suzuki,

Shoya Iwanami, Yasuhisa Fujita, Yong Dam Jeong, Jumpei Ito, Hiroyuki Asakura, Mami Nagashima, Kenji Sadamasu, Kazuhisa Yoshimura, Genotype to Phenotype Japan (G2P-Japan) Consortium, Kei Sato, Yoshiharu Matsuura, Teppei Shimamura, Shingo Iwami, Takasuke Fukuhara. Increased Flexibility of the SARS-CoV-2 RNA-Binding Site Causes Resistance to Remdesivir. **PLoS Pathogens**

- 19(3):e1011231 (2023).
- Jumpei Ito, Rigel Suzuki, Keiya Uriu, Yukari Itakura, Jiri Zahradnik, Kanako Terakado Kimura, Sayaka Deguchi, Lei Wang, Spyros Lytras, Tomokazu Tamura, Izumi Kida, Hesham Nasser, Maya Shofa, Mst Monira Begum, Masumi Tsuda, Yoshitaka Oda, Tateki Suzuki, Jiei Sasaki, Kaori Sasaki-Tabata, Shigeru Fujita, Kumiko Yoshimatsu, Hayato Ito, Naganori Nao, Hiroyuki Asakura, Mami Nagashima, Kenji Sadamasu, Kazuhisa Yoshimura, Yuki Yamamoto, Tetsuharu Nagamoto, Jin Kuramochi, Gideon Schreiber, Genotype to Phenotype Japan (G2P-Japan) Consortium, Akatsuki Saito, Keita Matsuno, Kazuo Takayama, Takao Hashiguchi, Shinya Tanaka, Takasuke Fukuhara, Terumasa Ikeda, Kei Sato. Convergent Evolution of SARS-CoV-2 Omicron Subvariants Leading to the Emergence of BQ.1.1 Variant. **Nature Communications** 14(1):2671 (2023).
- Tomokazu Tamura, Jumpei Ito, Keiya Uriu, Jiri Zahradnik, Izumi Kida, Yuki Anraku, Hesham Nasser, Maya Shofa, Yoshitaka Oda, Spyros Lytras, Naganori Nao, Yukari Itakura, Sayaka Deguchi, Rigel Suzuki, Lei Wang, Mst Monira Begum, Shunsuke Kita, Hisano Yajima, Jiei Sasaki, Kaori Sasaki-Tabata, Ryo Shimizu, Masumi Tsuda, Yusuke Kosugi, Shigeru Fujita, Lin Pan, Daniel Sauter, Kumiko Yoshimatsu, Saori Suzuki, Hiroyuki Asakura, Mami Nagashima, Kenji Sadamasu, Kazuhisa Yoshimura, Yuki Yamamoto, Tetsuharu Nagamoto, Gideon Schreiber, Katsumi Maenaka, Genotype to Phenotype Japan (G2P-Japan) Consortium, Takao Hashiguchi, Terumasa Ikeda, Takasuke Fukuhara, Akatsuki Saito, Shinya Tanaka, Keita Matsuno, Kazuo Takayama, Kei Sato. Virological Characteristics of the SARS-CoV-2 XBB Variant Derived from Recombination of Two Omicron Subvariants. **Nature Communications** 14(1):2800 (2023).
- Daichi Yamasoba, Keiya Uriu, Arnon Plianchaisuk, Yusuke Kosugi, Lin Pan, Jiri Zahradnik, Genotype to Phenotype Japan (G2P-Japan) Consortium, Jumpei Ito, Kei Sato. Virological Characteristics of the SARS-CoV-2 Omicron XBB.1.16 Variant. **Lancet Infectious Diseases** 23(6):655–56 (2023).
- Tomokazu Tamura, Daichi Yamasoba, Yoshitaka Oda, Jumpei Ito, Tomoko Kamasaki, Naganori Nao, Rina Hashimoto, Yoichiro Fujioka, Rigel Suzuki, Lei Wang, Hayato Ito, Yukie Kashima, Izumi Kimura, Mai Kishimoto, Masumi Tsuda, Hirofumi Sawa, Kumiko Yoshimatsu, Yuki Yamamoto, Tetsuharu Nagamoto, Jun Kanamune, Yutaka Suzuki, Yusuke Ohba, Genotype to Phenotype Japan (G2P-Japan) Consortium, Isao Yokota, Keita Matsuno, Kazuo Takayama, Shinya Tanaka, Kei Sato, Takasuke Fukuhara. Comparative Pathogenicity of SARS-CoV-2 Omicron Subvariants Including BA.1, BA.2, and BA.5. **Communications Biology** 6(1):772 (2023).
- Shigeru Fujita, Keiya Uriu, Lin Pan, Naganori Nao, Koshiro Tabata, Mai Kishimoto, Yukari Itakura, Hirofumi Sawa, Izumi Kida, Tomokazu Tamura, Genotype to Phenotype Japan (G2P-Japan) Consortium, Takasuke Fukuhara, Jumpei Ito, Keita Matsuno, Kei Sato. Impact of Imprinted Immunity Induced by mRNA Vaccination in an Experimental Animal Model. **Journal of Infectious Diseases** 228(8):1060–65 (2023).
- Shigeru Fujita, Yusuke Kosugi, Izumi Kimura, Kenzo Tokunaga, Genotype to Phenotype Japan (G2P-Japan) Consortium, Jumpei Ito, Kei Sato. Determination of the Factors Responsible for the Tropism of SARS-CoV-2-Related Bat Coronaviruses to Rhinolophus Bat ACE2. **Journal of Virology** e0099023 (2023).
- Izumi Kimura, Daichi Yamasoba, Hesham Nasser, Hayato Ito, Jiri Zahradnik, Jiaqi Wu, Shigeru Fujita, Keiya Uriu, Jiei Sasaki, Tomokazu Tamura, Rigel Suzuki, Sayaka Deguchi, Arnon Plianchaisuk, Kumiko Yoshimatsu, Yasuhiro Kazuma, Shuya Mitoma, Gideon Schreiber, Hiroyuki Asakura, Mami Nagashima, Kenji Sadamasu, Kazuhisa Yoshimura, Akifumi Takaori-Kondo, Genotype to Phenotype Japan (G2P-Japan) Consortium, Jumpei Ito, Kotaro Shirakawa, Kazuo Takayama, Takashi Irie, Takao Hashiguchi, So Nakagawa, Takasuke Fukuhara, Akatsuki Saito, Terumasa Ikeda, Kei Sato. Multiple Mutations of SARS-CoV-2 Omicron BA.2 Variant Orchestrate Its Virological Characteristics. **Journal of Virology** e0101123 (2023).
- Yu Kaku, Yusuke Kosugi, Keiya Uriu, Jumpei Ito, Alfredo A. Hinay, Jin Kuramochi, Kenji Sadamasu, Kazuhisa Yoshimura, Hiroyuki Asakura, Mami Nagashima, Genotype to Phenotype Japan (G2P-Japan) Consortium, Kei Sato. Antiviral Efficacy of the SARS-CoV-2 XBB Breakthrough Infection Sera against Omicron Subvariants Including EG.5. **Lancet Infectious Diseases** 23(10):e395–96 (2023).
- Hirofumi Aso, Jumpei Ito, Haruka Ozaki, Yukie Kashima, Yutaka Suzuki, Yoshio Koyanagi, Kei Sato. Single-Cell Transcriptome Analysis Illuminating the Characteristics of Species-Specific Innate Immune Responses against Viral Infections. **GigaScience** 12:giad086 (2022).
- Keiya Uriu, Jumpei Ito, Yusuke Kosugi, Yuri L. Tanaka, Yuka Mugita, Ziyi Guo, Alfredo A. Hinay, Olivia Putri, Yoonjin Kim, Ryo Shimizu, Mst Monira Begum, Michael Jonathan, Genotype to Phenotype Japan (G2P-Japan) Consortium, Akatsuki Saito, Terumasa Ikeda, Kei Sato. Transmissibility, Infectivity, and Immune Evasion of the SARS-CoV-2 BA.2.86 Variant. **Lancet Infectious Diseases** 23(11):e460–61 (2023).
- Martin Müller, Alexandra Herrmann, Shigeru Fujita, Keiya Uriu, Carolin Kruth, Adam Strange, Jan E. Kolberg, Markus Schneider, Jumpei Ito, Marcel A. Müller, Christian Drosten, Armin Ensser, Genotype to Phenotype Japan (G2P-Japan) Consortium, Kei Sato, Daniel Sauter. ORF3c Is Expressed in SARS-

CoV-2-Infected Cells and Inhibits Innate Sensing by Targeting MAVS. **EMBO Reports** 24(12):e57137 (2023).

Yusuke Kosugi, Arnon Plianchaisuk, Olivia Putri, Keiya Uriu, Yu Kaku, Alfredo A. Hinay, Luo Chen, Jin Kuramochi, Kenji Sadamasu, Kazuhisa Yoshimura, Hiroyuki Asakura, Mami Nagashima, The Genotype to Phenotype Japan (G2P-Japan) Consortium, Jumpei Ito, Kei Sato. Virological Characteristics of the SARS-CoV-2 Omicron HK.3 Variant Harboring the FLip Substitution. **Lancet Microbe** in press (2023).

Yuuka Masuda, Hesham Nasser, Jiri Zahradnik, Shuya Mitoma, Ryo Shimizu, Kayoko Nagata, Akifumi Takaori-Kondo, Gideon Schreiber, The Genotype to Phenotype Japan (G2P-Japan) Consortium, Kotaro Shirakawa, Akatsuki Saito, Terumasa Ikeda, Jumpei Ito, Kei Sato. Characterization of the evolutionary and virological aspects of mutations in the receptor binding motif of the SARS-CoV-2 spike

protein. **Frontiers in Virology** in press.

Yusuke Kosugi, Yu Kaku, Alfredo A. Hinay, Ziyi Guo, Keiya Uriu, Minoru Kihara, Fumitake Saito, Yoshifumi Uwamino, Jin Kuramochi, Kotaro Shirakawa, Akifumi Takaori-Kondo, The Genotype to Phenotype Japan (G2P-Japan) Consortium, Kei Sato. Antiviral Humoral Immunity against SARS-CoV-2 Omicron Subvariants Induced by XBB.1.5 Monovalent Vaccine in Infection-Naïve and XBB-Infected Individuals. **Lancet Infectious Diseases** in press (2023).

Yu Kaku, Kaho Okumura, Miguel Padilla-Blanco, Yusuke Kosugi, Keiya Uriu, Alfredo A. Hinay, Luo Chen, Arnon Plianchaisuk, Kouji Kobiyama, Ken J. Ishii, The Genotype to Phenotype Japan (G2P-Japan) Consortium, Jiri Zahradnik, Jumpei Ito, Kei Sato. Virological Characteristics of the SARS-CoV-2 JN.1 Variant. **Lancet Infectious Diseases** in press (2023).