Fiocruz, Tuesday, September 17, 2024

Workshop on the Mathematical Modelling of Variant Replacement of Infectious Diseases Pathogens

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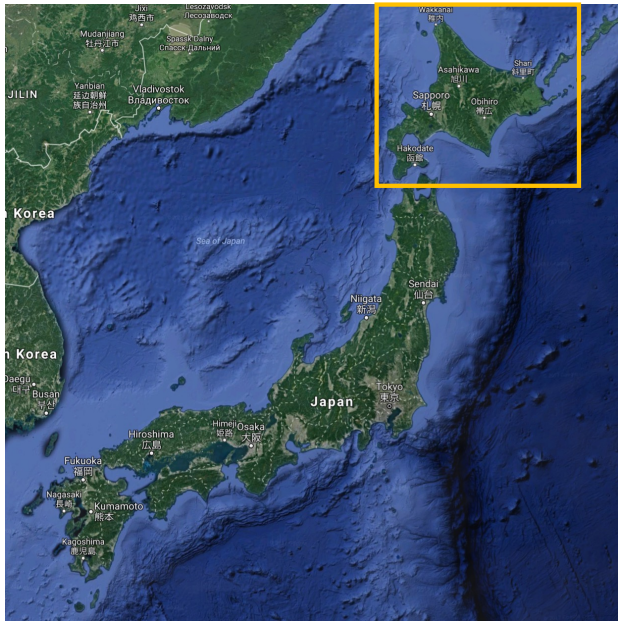
Japan 日本 にほん

Japan 🇯🇵		Brazil 🇧🇷
377,975 km²	Area	8,515,767 km²
123,970,000	Population	203,080,756
330/km²	Density	23.8/km²

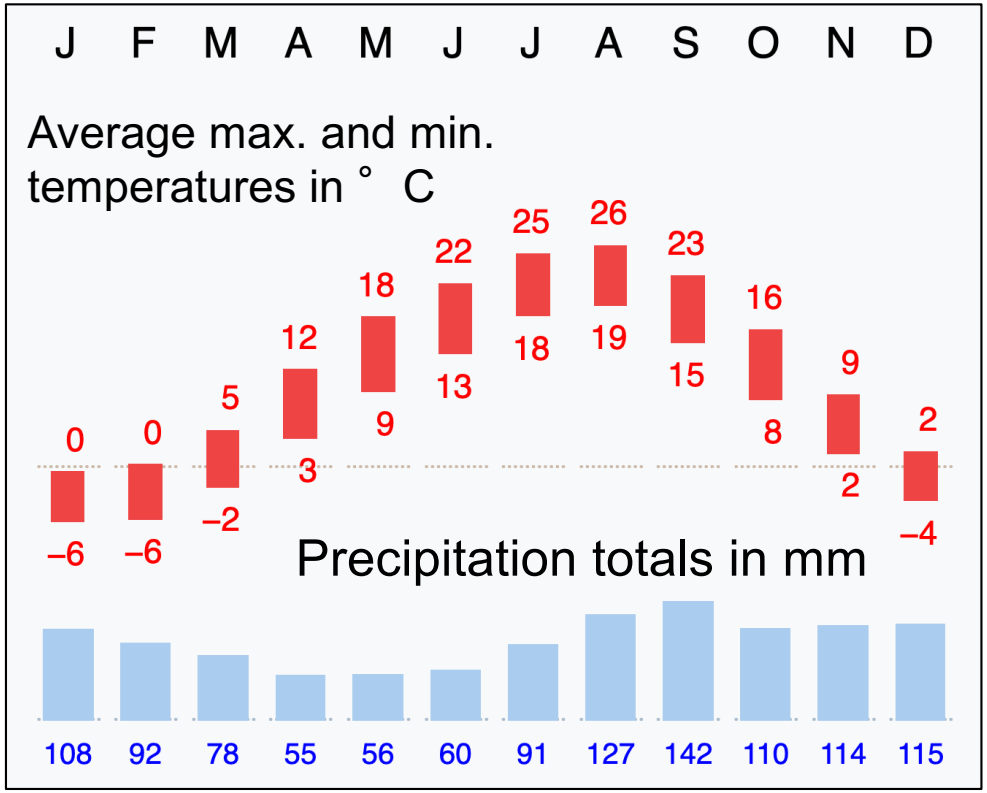
Hokkaido 北海道　ほっかいどう

- The northernmost island of Japan
- Population: 5.5 million
- Area: 83,450 km²



Sapporo 札幌 さっぽろ

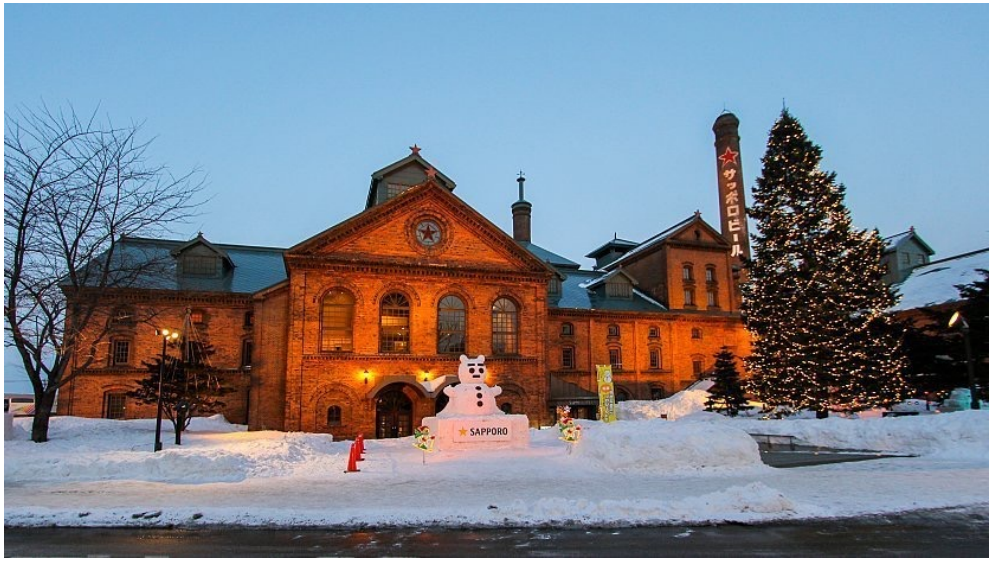
Area	1,121.26 km^2
Population	1,959,750
Time Zone	UTC+09:00 (JST)



Established in 1868

https://en.wikipedia.org/wiki/Sapporo

Sapporo　札幌　さっぽろ



Hokkaido University
北海道大学　ほっかいどうだいがく

- Founded in 1876 as Sapporo Agricultural College
- Educational Philosophy
  - Frontier Spirits
  - Global Perspectives
  - All-round Education
  - Practical Learning
- Students
  - 11,600 undergraduate students
  - 6,300 graduate students

International Institute for Zoonosis Control

- Established as the Research Center for Zoonosis Control in 2005
- Interdisciplinary research center specialized in the education and research for the control of zoonosis.
- Designated as “WHO Collaborating Centre for Zoonoses Control” in 2011

Kimihito Ito

Professor,
Division of Bioinformatics,
International Institute for Zoonosis Control,
Hokkaido University

- Graduate School of Information Science and Technology, Hokkaido University (-2005)
  - Machine Learning and Data Mining
- Research Center for Zoonosis Control, Hokkaido University (2005-)
  - Prediction of the Evolution of Influenza A Viruses

Contents of the Workshop

Tuesday, September 17, 2024

[Morning] Mathematical Models of Variant Replacement (Lecture)

[Afternoon] Maximum Likelihood Estimation of Relative Reproduction Number from the Variant Replacement Data (Lecture)

Wednesday, September 18, 2024

[Morning] Prediction of Variant Replacement in the Future (Lecture)

[Afternoon] Hands-on Training on the Prediction of SARS-CoV-2 Variants using the RelRe program (Practice)

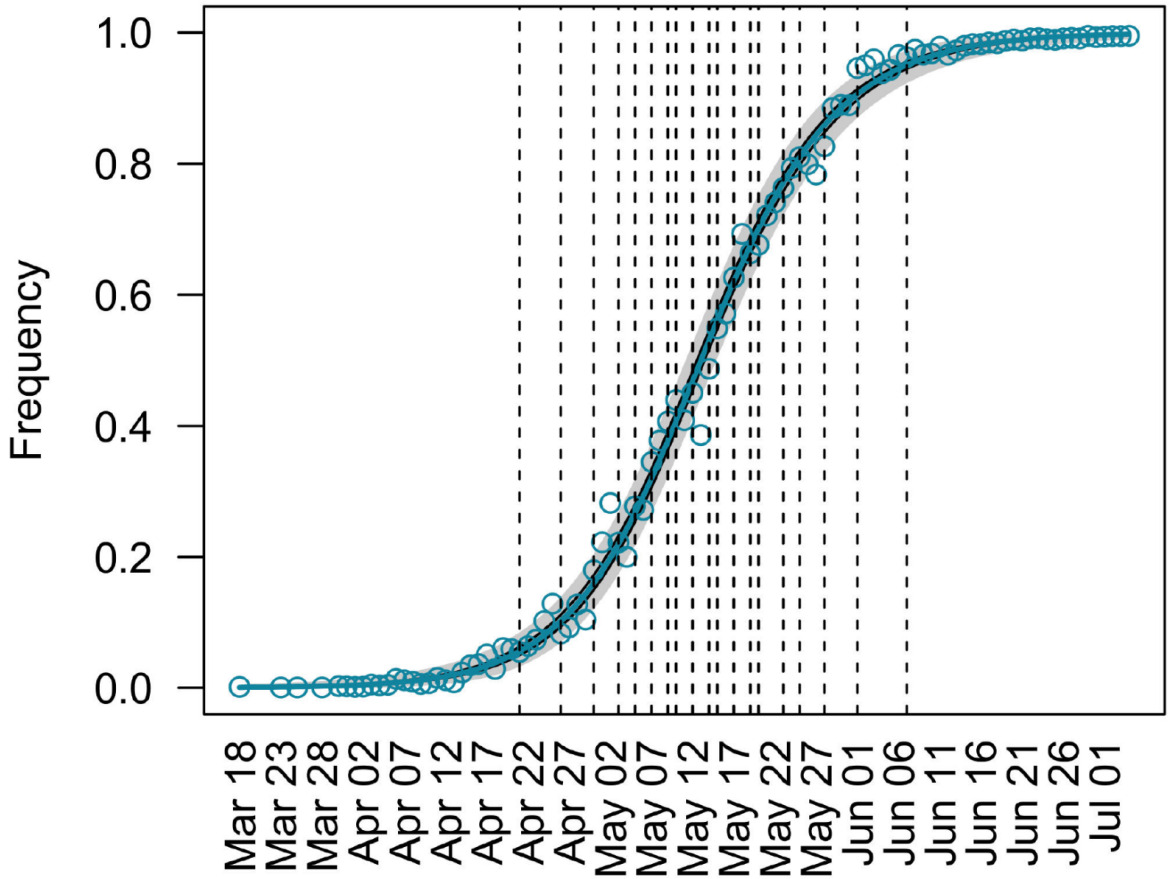
Thursday, September 19, 2024

[Morning] Hands-on Training on the RelRe program (Practice)

[Afternoon] General Discussion

Replacement of Variants (1)

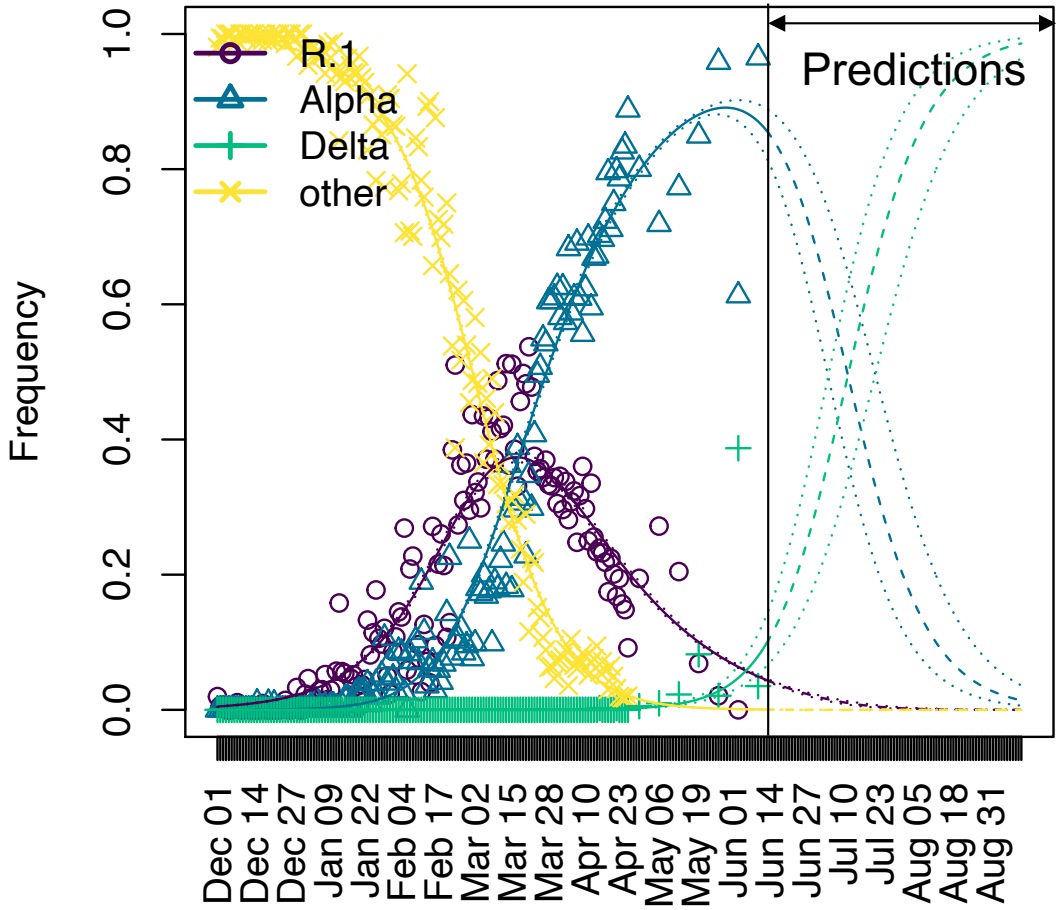
- Relative frequency of Delta variants of SARS-CoV-2 in England from 1 January to 31 July 2021.



An analysis of Alpha-Delta replacement using a total of 399,530 nucleotide sequences.
Circles: observations
Curve: model (Piantham & Ito, 2022)

Replacement of Variants (2)

- Relative frequency of R.1, Alpha, Delta, and other variants in Japan from Dec 2020 to Aug 2021



Circles: observations
Curves: model
(Ito, Piantham, Nishiura 2022)

The model can predict variant replacement in the future.

Mathematical Models

- A mathematical model is a mathematical description of a real-world phenomenon.
- The purpose of the model is
  - To understand the phenomenon,
  - To make predictions about future behavior.

Process of Mathematical Modeling