

Symposia | シンポジウムA

📅 Wed. Aug 27, 2025 2:30 PM - 5:15 PM JST | Wed. Aug 27, 2025 5:30 AM - 8:15 AM UTC 🏢 Room C(2F 123)

[SYA3] [A3] 発酵醸造文化の未来 — 伝統的酒造りのユネスコ無形文化遺産登録と次世代への継承

世話人：丸山 潤一（東京大学），渡邊 泰祐（日本大学）

4:35 PM - 5:05 PM JST | 7:35 AM - 8:05 AM UTC

[SYA3-05] Advances in Research & Development of *Koji* Mold and Future Prospects

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Keywords : *Koji* Mold、UNESCO Intangible Cultural Heritage、Traditional Sake Brewing、Research & Development、Advanced Technology

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He acquired Ph.D. from Graduate School of Agricultural and Life Sciences, The University of Tokyo (2001) and then continued postdoctoral research. He was appointed as Assistant Professor (2006) at The University of Tokyo, and during it he also studied as a guest researcher at Georg August University Göttingen, Germany (2010). He became Project Associate Professor (2016), Project Professor (2021), and then Professor (2025) at The University of Tokyo.

Koji mold is a microorganism used in Japanese traditional brewing industry, and its importance was recognized again in the registration of "Traditional Sake Brewing" on the UNESCO Intangible Cultural Heritage list in 2024. *Koji* mold is also used to produce enzymes and proteins/natural products derived from different organisms, and recently the fungus itself has attracted attention as an edible protein source.

Research on *koji* mold has made great progress since the first whole genome sequence was deciphered in 2005. With the development of technology that enables highly efficient genetic manipulation, functional analysis and functional development of many genes have been actively carried out. For an example, the authors have been conducting functional analysis of genes in the intracellular organelles of *koji* mold, and in the process discovered for the first time that peroxisomes are involved in the biosynthesis of biotin, one of vitamins. This discovery led to the idea of developing an *amazake*, in which vitamins produced by *koji* mold play an important role, and it was released as "Doctor's Old *Koji* Amazake" using *koji* mold strains that Dr. Kinichiro Sakaguchi, Professor Emeritus of The University of Tokyo, known as the "God of Sake", had collected before or during Pacific War.

On the other hand, the genetic manipulation of *koji* mold as described above has been carried out mainly on the RIB40 strain, the first whose whole genome sequence was deciphered. In fact, there are a wide variety of industrial strains of *koji* mold suitable for various purposes, such as sake, soy sauce, *miso*, and genetic manipulation of these industrial strains has been extremely difficult and inefficient. With the genome editing technology CRISPR/Cas9 system, the efficiency of gene manipulation in industrial *koji*

mold strains was dramatically improved, also enabling multiple gene modifications. By modifying the metabolism of *koji* mold on a large scale, metabolic production capability was significantly improved, demonstrating that these approaches are effective in developing functions to greatly explore the potential of *koji* mold.

In recent years, with the development of next-generation sequencing technology, the deciphering of the genome sequences of many industrial strains of *koji* mold has been reported. Analysis using genome editing technology based on the results of comparative genome analysis has allowed us to link the diverse characteristics and gene functions of industrial *koji* mold strains that have been specialized for various uses. Furthermore, it is expected that the breeding and development of *koji* mold aimed at true industrial use will become possible by performing efficient and flexible genetic modifications of strains with industrially excellent properties.

In addition to the background of *koji* mold having been used for many years in the brewing industry in Japan, there is growing interest in its use in new industrial fields and even overseas. It is expected that the potentials of *koji* mold will be maximized by combining traditional knowledge and advanced technology, which will lead to the creation of diverse new food industries and cultures.