

R&D Item

1. Intracellular CA's E³LSI study

Progress until FY2024

1. Outline of the project

The technical safety and fairness of intracellular cybernetic avatars (hereafter referred to as intracellular CAs) is essential for the use of these technologies.

Since intellectual property, such as detailed technical information on intracellular CAs, must be strictly managed, this research project is developing a mechanism for widely sharing information on the safety evaluation of intracellular CAs, which was conducted based on the perspectives of E³LSI (ethical, economic, environmental, legal, and social issues), and an information management platform that ensures security.

We will establish a system to store, manage, and share the individual experimental data conducted in each of the research projects from R&D items 2 to 6 while ensuring security and preventing the data from being dispersed. This will enable rapid information sharing between R&D item managers and smooth collaboration between the items.



(1-1) Investigation & Evaluation of E³LSI Study of Intracellular CAs

Yoko Yamanishi
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(1-2) Construction & Operation of the Information-Sharing Platform to Promote the Development of Intracellular CAs

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2. Outcome so far

In FY2022, we selected experts specializing in E³LSI, including those with expertise in legal affairs, science and technology society theory, and biomedical ethics. We also conducted trend surveys to launch a consortium for the manufacturing and design of intracellular CA through corporate interviews, etc.

In FY2023, we established the E³LSI Review Committee, together with industry advisors and experts in legal affairs, science and technology society theory, and biomedical ethics. Currently, we have conducted surveys of literature on intracellular CA to launch a consortium for the manufacturing and design of intracellular CA. In addition, we conducted a surveys of prior art to evaluate the novelty of our research. We added a research and development item "(1-2) Construction & Operation of the Information-Sharing Platform to Promote the Development of Intracellular CAs" with the aim of establishing a mechanism for widely sharing information on the safety evaluation of intracellular CA and ensuring security, collected public data and compiled it into a database, obtained the optimal prompt for collecting information from literature information, and proceeded with the development of the information infrastructure.

In FY2024, in (1-1), we launched the E³LSI management system and the intellectual property management system. Additionally, we conducted working group activities to develop guidelines for the use of intracellular CA. Furthermore, we gathered information and carried out a research trend survey on the application of intracellular CA. We exhibited a project booth at Science Agora 2024 and conducted a questionnaire-based survey on social acceptability at Science Agora 2024. (Figure 1).

In (1-2), we developed a user interface for storing and viewing intracellular CA-related data, along with a login authentication function accessible via a web browser for project members.



Figure 1 A photo of the project booth at Science Agora

Additionally, we built a system to register and manage experimental data on intracellular CA and interactions between CA-equipped cells, streamlining data sharing within the project. Furthermore, we created a system to automatically collect text data from literature on intracellular CA, gathering over 10,000 abstracts related to CAR-T cell development and synthetic biology cell engineering. Using a large-scale language model, we generated summaries of these texts and organized them in a database for efficient knowledge management.

3. Future plans

The E³LSI Review Committee will work with researchers to consider issues related to the use of intracellular CAs from the early stages of research. In addition, a consortium led by the Industrialization Review Committee established within the Committee will examine practical economic issues such as distribution and storage in order to realize the social implementation of intracellular CA use.

To establish a mechanism for widely sharing information on the safety evaluation of intracellular CAs and an information infrastructure that ensures security, we will build a data-driven intracellular CA design system and an information infrastructure to efficiently support the development and design of intracellular CAs, and store, manage, and share the information while ensuring security.