02
Research

Center for 5D Cell Dynamics

Fusion of different fields to create the next generation

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Research by interdisciplinary collaboration is the world trend

In recent years, analysis technology at the single cell level, omics measurement technology that performs comprehensive analysis by focusing on specific functional molecules in the living body, imaging technology that visualizes measured information, and computational science such as AI have made remarkable progress. Along with this, it is becoming possible to capture life phenomena as a biological control system consisting of intermolecular networks in cells and communication between cells, and to visualize their spatiotemporal dynamics quantitatively and model mathematically. From the dynamics of such interactions between biomolecules or cells, it is difficult to understand complex biological phenomena and diseases that occur at the macro level from a single research field, and it is essential to collaborate and integrate in various fields such as biology, medical and engineering, computer science, mathematical science, physics, and chemistry. Already overseas, the Broad Institute which was jointly established by Massachusetts Institute of Technology and Harvard University in the US, and the Francis Crick Institute which is the largest biomedical research institution in the UK, have a great presence under the framework of open science and interdisciplinary collaborations that promote a variety of research.

Based on world trends, the necessity of working with an under-one-roof style (*) in which researchers from different fields with few contacts are able to collaborate and conduct modeling and experimental verification cycles efficiently as well as the need to create integrated research centers, is increasing even in Japan.

* Under-one-roof style:
Work formation where researchers from different fields work together on research and development under one roof.

Launching a fusion research center that fundamentally changes medicine

Under these circumstances, in January 2020, our Graduate School of Medicine established "Center for 5D Cell Dynamics; C5CD." The "5D" (D as in dimension) in the name of this center comes from the advanced concept of "4D" , which represents 3 special dimensions with 1 temporal dimension, combined with a new dimension comprised of leading-edge medicine and informatics working in close collaboration to form "laboratory connections." We strive to play a role as a hub for promoting fusion research and to promote research that fundamentally changes medicine and related technology.

This center is an organization of mixed labs consisting of wet labs (Professor NISHIKAWA Hiroyoshi and Designated Assistant Professor HINOHARA Kunihiko from the Department of Immunology) and an informatics lab (Professor SHIMAMURA Teppei from the Department of Systems Biology) Starting with the introduction of leading edge equipment and technologies such as 10X genomics Chromium and Hyperion imaging system to acquire the high-quality multi-omics data they use to support the analysis and visualization of multi-dimensional data using leading edge analysis technology. We have been able to put in place a system that accelerates research by research design through close collaboration between both wet and dry labs.

Based on the concept of the "mixed lab" , the laboratory adopts a cool design that creates and expansive atmosphere with an attractive wood pattern as you enter, while also providing an open space in which researchers of both wet and dry labs can work without boundaries.

This center also plays a role as an interdisciplinary research center in the "Convolution of Informatics and Biomedical Science on Glocal Alliance (CIBoG) WISE Program" which was adapted in 2019.

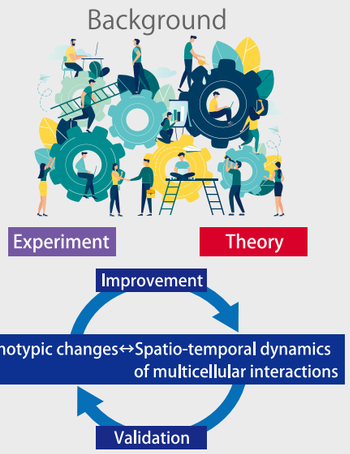
Developing human resources who will lead the fusion of medicine and informatics

Today, cross-disciplinary fusions are invaluable to bring breakthroughs in medicine and biology field. Although this center has just been established, the lab is filled with the energy and vitality between different fields and is likely to become a new standard for basic research. In January 2020, the 15th Premium Lecture (TOKURON Special Lecture) was held to introduce the various research activities that the center is developing, and lectures were given by the people from government and industry, along with lively discussion on single cell technology and domestic trends and prospects of research.

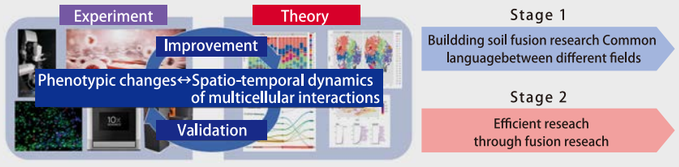
In addition, as our latest activity, we plan to hold a science cafe that introduces behind-the-scenes aspects of science that cannot be heard in ordinary lectures targeted at researchers within Nagoya University, as well as other events that effectively utilize the center.

Going forward, we would like to promote close collaborative work in various research fields as a new research hub that accelerates fusion research both inside and outside the university in order to solve medical problems.

At the same time, we would like to develop researchers and clinicians who can understand the language of both wet and dry labs and contribute as a bridge for the fusion of different fields, to form the base for promoting fusion research in medicine and informatics at CIBoG.



In order to elucidate the diversity and dynamics of livingsystems,it is necessary to develop mathematical models of the phenomena and to verify them by experiments. To this end, we should shift from conventional individual research in each field to collaboration and integration of different fields of research and development.



- Developing analytical approaches to understand and controi biological systems based on mathematical models
- Promoting innovation in life science and medical science through interdisciplinary research