Title of Project：Post-Koch Ecology: The next-era microbial ecology that elucidates the super-terrestrial organism system

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【Purpose of the Research Project】

The Earth is home to a system of super-terrestrial organisms, where the terrestrial environment and diverse living organisms interact. Microorganisms account for half of all living organisms in the biosphere. The number of microorganism species ranges in the millions, much greater than the numbers of animal, plant, and insect species. Therefore, understanding microbial ecology is essential for understanding the overall ecology of super-terrestrial living organisms.

Many microorganism species have been isolated from the environment; however, those that have been isolated still only constitute less than 1% of all microbial species on Earth. Establishing a novel microorganism isolation technique will be the key to understanding the entire picture of super-terrestrial living organisms.

We will create a novel post-Koch microorganism isolation technique that integrates science, engineering, and microbiology to find microorganisms that have yet to be isolated. Furthermore, we will use functional informatics to take full advantage of ecological and information science to establish a novel ecological system model that is centered on microorganism species as well as their functions and growing environment. This post-Koch functional ecology model will be the basis for elucidation of principles of the super-terrestrial organism system.

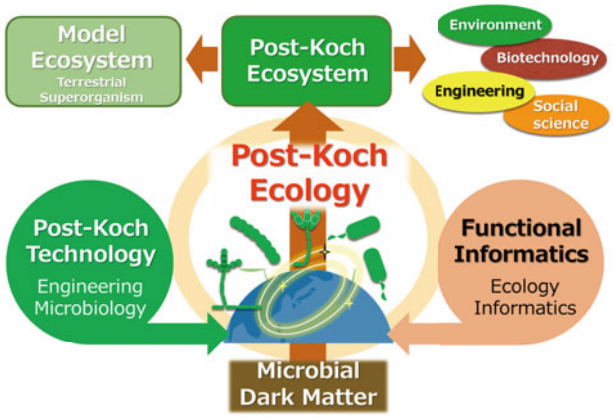

Figure 1 Research strategy and expected achievements

【Content of the Research Project】

Ten groups will advance research under two research tasks. Task A01 will be to develop an innovative post-Koch technique to isolate unknown microorganisms. Specifically, we aim to develop an innovative technique for the isolation, culturing, and analysis of microorganisms, utilizing diverse technologies such as micro-electronic mechanical systems, spectroscopy, and microscopic imaging. Discovery of new microbial species will elucidate their functions, and enhance the diversity of microorganisms. Task A02 will be to create a post-Koch ecology model by developing new bioinformatics technologies to integrate and perform network analysis on information about species, genes, functions, and the environment of microorganisms. The integrated analysis of environmental data and microorganism data will be addressed along with research on the functions of a complex organism system in the environment and technologies that transform enormous amounts of microorganisms into bioresources. Under these two research tasks, we aim to activate the whole research area through collaboration utilizing the shared experimental farm and data obtained therefrom.

【Expected Research Achievements and Scientific Significance】

A post-Koch functional ecology model that has one of the largest collections of information about species, genes, functions, and the environment of microorganisms will be established, allowing for ecology to be understood on the basis of the physiological functions of microorganisms in the environment. The outcomes from this research will contribute to agriculture, life science, engineering, biotechnology, and social sciences. Microorganisms are associated with many fields of study under the Sustainable Development Goals (SDGs). Therefore, this research area will evolve into a core academic area that supports SDGs beyond existing academic areas.

【Key Words】

Microorganism: A living organism that is too small to be seen with the naked eye. Microorganisms have the highest biodiversity on Earth and include bacteria, archaea, and fungi.

【Term of Project】

FY2019-2023

【Budget Allocation】

1,154,300 Thousand Yen

【Homepage Address and Other Contact Information】

http://postkoch.jp/