

Research area in Strategic Objective “Measuring “resilience of life” — Discovery and exploration of unknown biological response mechanisms”

Elucidating the power of life through innovative measurement and analysis techniques

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Overview

Based on the Strategic Objective “Measuring ‘resilience of life’ — Discovery and exploration of unknown biological response mechanisms,” the goal of this research area is to elucidate "the power of life" through a needs-oriented, cross-disciplinary approach that utilizes various measurement parameters. We also aim to develop innovative measurement and analysis techniques to visualize and characterize "the power of life," and to elucidate it utilizing the techniques developed.

In this research area, the concept of "the power of life" encompasses the fundamental properties of life, including the ability to change dynamically while maintaining a certain identity (dynamism), the ability to withstand harsh environments (robustness), and the ability to constrain "fluctuations" caused by external stimuli and internal factors (homeostasis). However, "the power of life" is not limited to these features, and researchers participating in this research area will pursue their own concept of "the power of life" and seek to elucidate and understand it. The term "the power of life" includes both the power that life produces and the power that produces life.

To elucidate "the power of life," we will develop innovative measurement and analysis techniques to meet the demands of life sciences by organizing cross-disciplinary teams among researchers. In addition, we aim to reveal the unexplained elements of "the power of life" by overlaying various parameters, such as measurements over a wide range of temporal and spatial scales of life, and measurements across these scales.

We hope that this research area will create a new view of life through the development of innovative measurement and analysis techniques that meet the demands of life sciences and the elucidation of previously unknown or neglected elements of "the power of life."

Research Supervisor's Policy on Call for Application, Selection, and Management of the Research Area

1. Background

The measurement and visualization of life phenomena is the foundation of life science research, and much of the progress in modern life sciences can be attributed to innovations in measurement technology. To date, advanced technologies have been developed, such as techniques for measuring life phenomena at various time and space scales and measurement technologies for acquiring vast and complex data. However, there are still many challenges in life sciences that can be solved through innovations in measurement and analysis techniques, which requires the development of measurement techniques that combine elemental technologies and truly meet the needs of the life science field.

In this research area, we aim to reveal "the power of life" through the integration of various measurement parameters by taking a needs-oriented, cross-disciplinary approach to the life science field in order to achieve the following two goals: (1) the development of innovative measurement and analysis techniques to visualize and characterize "the power of life", and (2) the elucidation of "the power of life" using the developed techniques.

2. Principle of invitation project and selection

This research area invites research proposals that challenge the creation of a new view of life through (1) the development of innovative measurement and analysis techniques and (2) the elucidation of "the power of life " by utilizing these techniques.

We expect the formation of a research team capable of achieving both (1) and (2) mentioned above. Because of the importance of a cross-disciplinary approach to the development of measurement and analysis techniques, we recommend the formation of a research team consisting of researchers from various research fields.

(1) Developing innovative measurement and analysis techniques

One of the goals of this research area is to develop innovative measurement and analysis techniques to visualize and characterize the unexplored or neglected elements of "the power of life."

In your proposals, please try to develop measurement techniques that meets the demands of the life science field and avoid developing measurement technology for the sake of measurement. We expect not only the development of completely new technologies, but also the development

of techniques to measure life phenomena from new perspectives and parameters through cross-disciplinary approaches, such as combinations of existing measurement technologies and parameters, and the application of measurement technologies and parameters that have not been utilized in the life science field. In this research area, we do not limit the scale of the life phenomena to be measured, ranging from an entire organism to a single molecule in a cell. However, we hope that your proposals will lead to the elucidation of the larger concept of "the power of life", and not just to an understanding of local life phenomena.

For analysis techniques, we expect innovative technological developments that can create a new view of life from measured data. Even if the measurement technique used to acquire the data is an existing one, proposals that lead to a significant advancement in our understanding of "the power of life" by combining innovative analytical techniques are also eligible. We also expect the application of information science, such as AI and data science, to the life science field to find new meanings from enormous and complex data.

(2) Creating a new view of life through elucidating "the power of life"

Another goal of this research area is to elucidate the unexplored elements of "the power of life" by utilizing innovative measurement and analysis techniques. When applying to this research area, we request that research proposals not only develop the innovative measurement and analysis techniques, but also aim to elucidate and understand "the power of life" by utilizing these techniques.

We do not limit the definition of "the power of life" and welcome proposals for "the power of life" as conceived by the applicants themselves. We expect research proposals to discover a new concept of "the power of life" by using new techniques and parameters to measure and analyze life phenomena whose biological significance has not been understood or neglected. Furthermore, we expect research proposals that challenge the creation of a new view of life based on "the power of life" elucidated in this research area.

3. Research periods and research funds

The research period should not exceed five years and six months (2024 - 2029). The maximum budget for a research project is 300 million yen at the beginning (direct expenses).

Please submit your application after carefully examining the amount appropriate to the size of your research team and the amount necessary to achieve the proposed content. Please note that the research budget may be adjusted upon selection as a result of close examination by the research supervisor.

The research budget will be reviewed on an annual basis. As a result of the review, the research budget may be increased or decreased to reflect the progress of the research. After selection, an interim evaluation will be conducted approximately three years after the start of the research. Depending on the results of the evaluation, we may revise the research budget or request a reorganization of the research team.

4. Others

Proposals that seek only to demonstrate the requirement for a specific element of "the power of life" by genetics or other means will not be considered. Innovative measurement and analysis techniques should be expected to form the basis of the proposal.