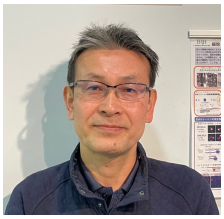
Laboratory of Biohistory

JT Biohistory Research Hall



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URL: https://www.brh.co.jp/en/research/

We, the laboratory of biohistory, conduct experimental and theoretical research aimed at deciphering the historicity, diversity, commonality, hierarchy, and emergence embedded in the genomes of living organisms, in order to grasp the essence of living entities encompassing cells, development, evolution, and ecosystems. By focusing on genomes rather than individual genes or species, we believe that studying a wide range of organisms reveals the holistic nature of life. Our approach is characterized by a fundamental love for living organisms, with a commitment to cherishing the research questions and practical processes undertaken by each individual. Currently, our laboratory is primarily engaged in research themes related to cell biology, developmental biology, evolutionary biology, and mathematical biology, as described below.

Evolution and diversification of cell-cell adhesion structures in multicellular animals

In the cell-cell adhesion structures of multicellular animals, classical cadherins that connect cells have diverse primary structures depending on the animal lineage. The mechanism of cell-cell adhesion, which has been well understood in vertebrates, does not necessarily apply directly to invertebrates. We aim to understand how early multicellular animals initiated cell-cell adhesion and how diverse mechanisms have emerged from primitive structures. To achieve this, we are conducting explorations using invertebrates as materials, employing a multidisciplinary approach including genetics and structural studies.

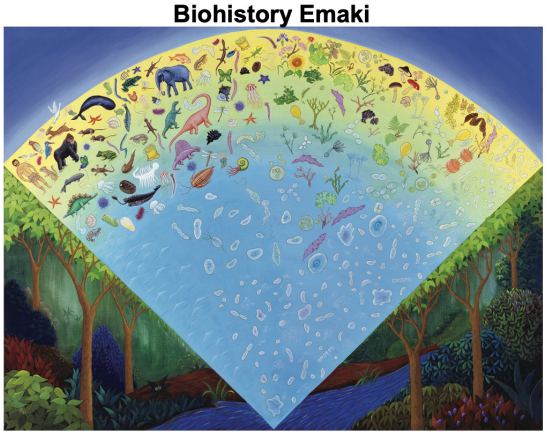
Exploaration of ancestral mechanisms of arthropod development

Multicellular animals have evolved diverse forms through the formation of body axes and repetitive structures. In particular, the phylum Arthropoda demonstrates a remarkable diversity of evolution among species while sharing a body axis with repetitive patterns. Fragmentary data to date suggest that even morphological traits common to arthropods have diversified in the processes forming them across species and lineages. To address questions regarding the developmental mechanisms of ancestral arthropods, why developmental processes have diversified, and how such diversification has been achieved, we are utilizing our established experimental system with spiders.

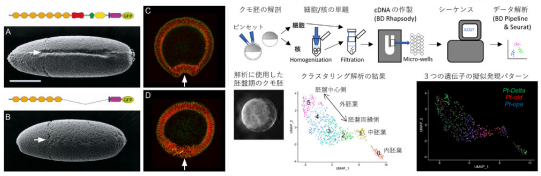
Theoretical research on the relationship between development and evolution in arthropods

What is an phylum, a group of animals sharing a body plan? Answering this fundamental question requires an understanding of the relationship between the development and evolution of animals. However, there are limitations to addressing this issue through comparative analyses using actual organisms or evolutionary experiments. Therefore, we are constructing a platform for numerical experimentation by creating virtual multicellular bodies represented as sets of polygons on computers, using the phylum Arthropoda as a model. This platform integrates mechanisms for dynamically moving cells and genetic networks, as well as intercellular interactions, allowing us to experiment with arthropod-like development and evolution through computational simulations.

Biohistory Emaki



Experiments using fruit flies (left) and spiders (right)



Exciting and significant discoveries are still waiting to be made. We invite you to visit our laboratory to see our latest endeavors firsthand.

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Scan here for the lab's website >>