


【Grant-in-Aid for Transformative Research Areas (B) 】

Natural Products Biology: Physiological significance of plant secondary metabolites

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	Project Information	SETO Yoshiya Project Number : 24B306 Keywords : Secondary metabolite, Natural product, single cell RNA seq, Target identification Researcher Number : 40620282 Project Period (FY) : 2024-2026

Purpose and Background of the Research

●Outline of the Research

Plants, which can not change those living places, produce a great variety of metabolites in their characteristic lifestyle. Among them are a group of molecules called secondary metabolites, some of which have been effectively utilized in human lives. The major academic field that deals with secondary metabolites is called "natural product chemistry," and research has been conducted mainly from a chemical perspective. However, the biological significance of these metabolites to the producing organisms and to the surrounding environment remains largely unknown, and this is an unexplored area of natural products research. Elucidating the physiological significance of natural products will lead to a deeper understanding of living systems from a different aspect. One of the reasons why the biological significance of natural products has not been fully elucidated is a lack of a systematic methodology to approach this question. Therefore we propose "natural product editing" in which the functions of natural products are edited by genome editing or chemical biology approach. In addition, gene expression analysis at the single-cell level and the development of methodologies to efficiently identify natural product targets will be incorporated. We believe that these approaches will pave the way to dissect the physiological significance of natural products, leading to the establishment of new research areas.

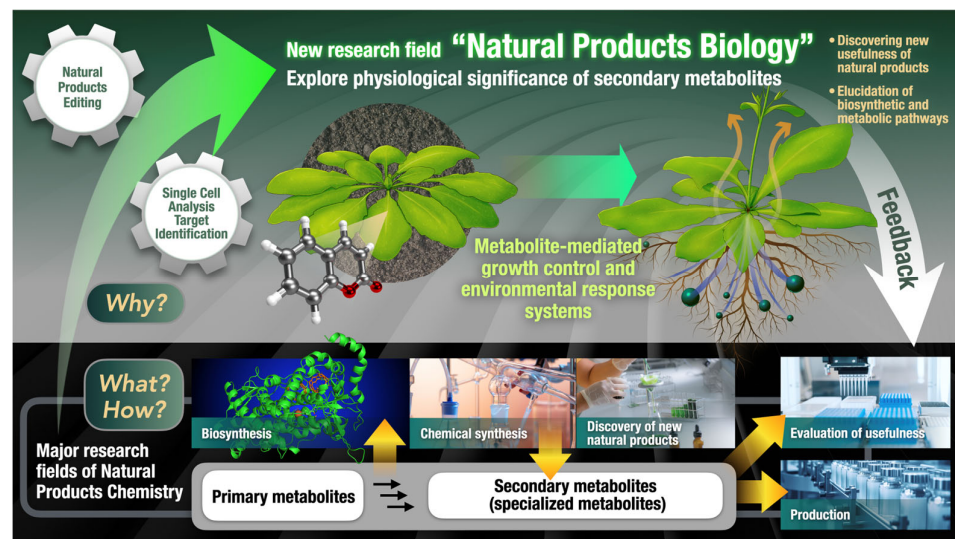


Figure 1. Image of this research area

●Methodology supporting this research area

①Natural products editing

It is expected that the biological significance of a specific natural product will be clarified by creating organisms in which its function is deleted.

②Single cell analysis

Gene expression analysis in a single cell is adapted to natural products study

③Target identification

The method to identify the natural products target will be developed and introduced to elucidate the biological significance of natural products.

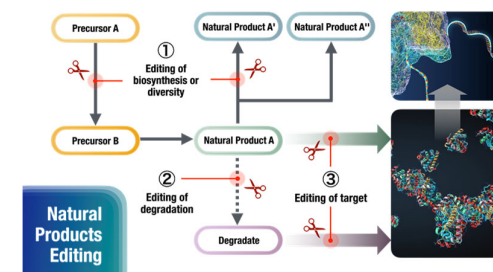


Figure 2. Outline of 'Natural products editing'

Expected Research Achievements

●Overall overview of this research area and research content of each research group

In addition to three independent groups (Groups A01-A03), each of which targets its secondary metabolite, Group A04 will support the above three groups from a methodological viewpoint. The three project teams aim to elucidate the physiological significance of their target secondary metabolites, by collaborating with Group A04.

Group A01 (Yoshiya Seto)

Root parasitic plants have a unique life cycle in which they parasitize other plants root. Group A01 aims to elucidate the biological significance of phenylethanoid glycoside natural products highly accumulated in root parasitic plants.

Group A02 (Michio Sato)

Some phytopathogenic fungi produce plant hormones as secondary metabolites. Group A02 aims to elucidate the physiological significance of jasmonic acid production by a phytopathogenic fungi, *Lasiodiplodia theobromae*.

Group A03 (Ryosuke Sugiyama)

Coumarin, a plant secondary metabolite, is secreted into the soil under iron deficiency and contributes to alleviating iron deficiency symptoms. Coumarin also exists as a glycoside molecule. Group A03 aims to elucidate the mechanism of iron deficiency response through dynamic switching between glycosylation and hydrolysis using coumarin as a model.

Group A04 (Makoto Shirakawa, Yusuke Aihara)

As a methodology for elucidating the physiological significance of plant natural products, this group will work on the establishment of methodologies such as single cell analysis and target identification. In addition, the group will closely collaborate with A01-A03 and provide technical support for the research conducted by each project group.

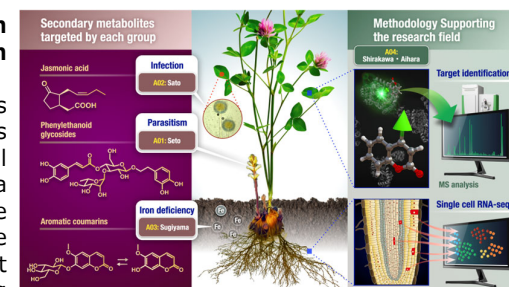


Figure 3. Outline of the research plan to be conducted by each planning group

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Address, etc.

<https://naturalproductsbiology.org/>