Laboratory of Molecular Microbiology

Theme

Studies on bioactive compounds from filamentous fungi
- Search for novel bioactive compounds and their biosynthetic genes
- Creation of novel compounds by genetic engineering
- Overproduction system of bioactive compounds through genetic engineering

Studies on bioactive compounds from Actinomycetes
- Elucidation of regulatory network for secondary metabolism
- Development of control methods for secondary metabolism
- Study on the mechanism for potato scab disease to develop the prevention method
- Search for novel bioactive compounds and their biosynthetic genes

Research

Although filamentous fungi or molds appear unfavorable because they spoil foodstuff and cause uncomfortable living environment, they are in fact very important organisms because they are essential to produce daily foods throurgh fermentation, such as sake, soy sauce, cheese. Moreover, many bioactive compounds (such as antibiotics) are the products of fungi, and thus fungi are giving great benefits to human health.

Genome analysis revealed that filamentous fungi contain as many as 50 biosynthetic genes for bioactive compounds. We consider filamentous fungi as high-potential bioresource for novel bioactive compounds to confront with novel pathogens and multidrug resistance bacteria, and intend to make the best use of them to contribute to human community.

Since the discovery of anti-Tuberculosis drug streptomycin in 1943, numerous bioactive compounds have been discovered from the secondary metabolites of soil bacteria actinomycetes and these compounds give great benefits to human health. We study on the regulatory mechanism of secondary metabolism in actinomycetes, and try to utilize microorganisms for mass production and discovery of bioactive compounds by genetic engineering with the knowledge obtained through the analysis of regulatory network.

In addition, some actinomycetes possess unique characters: toxin production in potato scab disease and living ability in particular circumstances such as in ocean. We intend to apply our results to prevent damage by the pathogen in agriculture and for creation of novel medicines.

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Laboratory for Applied Microbiology

Theme

Development of system for recombinant pharmaceutical proteins

Development of potentials of host cells
- plant/plant cells/insect/insect cells

Development of posttranslational modification, particularly glycosylation
- Development and functional analysis of glycan modification enzymes
- Engineering of glycans

Research

Although production platforms for recombinant pharmaceutical proteins have well developed using yeasts, insect cells, plants and etc, resultant proteins are glycosylated in a manner different from that in the corresponding native host, and thus these proteins are devoid of biological functions. Therefore, system to properly glycosylate the target proteins is urgently required.

Currently, antibody production with human-type glycan structures are in progress in this laboratory using plant suspension-cultured cells and plant itself by introducing human glycosylation system into plant. This system has some advantages, because it uses solar energy, not fossil fuels, and free from animal pathogens.

In addition to plant cells, we are exploring potential of glycosylation in several host cells including insect cell system, and are on the way to establish technology to produce recombinant proteins possessing human-type glycan structures.

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