PM-09

Characterization of *Escherichia coli* small colony variants frequently emerged in biofilms

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大腸菌バイオフィルム内で発生する小コロニー形成株の特性解析

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Key word : biofilm , small colony variants, cell shape, drug resistance, mutation

Bacteria show various phenotypes to cope with uncertain environments. One of the strategies is the emergence of small colony variants (SCVs). On the other hand, bacteria are capable of living in biofilms that are thought to be the dominant growth mode for bacteria in natural environments. It has been recognized that there are differences of gene expression profiling between biofilm and planktonic in *E. coli*. In previous study, it has been shown that SCVs are generated more frequently in biofilm in *P. aeruginosa*. However, there is limited information on the emergence of *E. coli* SCVs in biofilms and its mechanism. Here we provide new insights into the emergence of SCVs in biofilms in *E. coli*. We have found that SCVs emerged more frequently in biofilms in *E. coli*. SCVs show a higher resistance to some antibiotics and lower growth rate than the wild type. Furthermore, it should be noted that *E. coli* SCVs present spherical cell shape. We therefore focused on the unique phenotypes such as low growth rate and spherical cell shape and analyzed the gene sequence of *rodZ*, that is thought to be responsible for the low growth rate and spherical cell shape. However, no mutation site was found in SCVs, indicating that other genes and/or regulation networks may control the cell shape. We are now trying to identify the generation mechanism of SCVs based on a comparative genomic analysis.

PM-10

Population dynamics of a mucoid mutant and wild type strain in *Pseudomonas aeruginosa* biofilms

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緑膿菌バイオフィルム中におけるムコイド変異株と野生株の環境による優占菌株の変化

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Key word : Biofilm, Mucoid mutant, Denitrification, Nitric oxide

Most of the microbes form complex aggregation called biofilms to adapt to the environment in their natural habitats. It is said that biofilms increase the resistance to many kind of stress and also avoid predation compare to that of planktonic cell. Interestingly, the frequency of spontaneous mutation inside biofilms is much higher than planktonic cells, and some of them have extremely high resistance to drugs and stress, and are considered to contribute to the environmental adaptation of biofilms. Hence, research on these mutants is indispensable. However, how these mutants behave in biofilms has not been fully understood. At first we focus on understanding the behaviors of a mutant in biofilms to investigate the role of mutants in environmental adaptation. The alginate-overproducing (mucoid) mutant of *P. aeruginosa* was used. We have showed that the mucoid strains become predominant against nonmucoid wild type under denitrifying conditions.
In this study, we examined how the mucoid strain becomes dominant against the nonmucoid strain under denitrifying conditions in biofilms. As a result, it was suggested that the mucoid strain has higher resistance to a denitrification intermediate metabolite, nitric oxide, compared to the wild type strain. Thus, the emergence of mucoid strains may be involved in the environmental adaptation of *P. aeruginosa* under denitrifying conditions.

PM-11

The effect of biofilms on the rhizoplane and tomato growth cultivated on organic hydroponic culture system

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有機水耕におけるトマトの成長と根面バイオフィルムの効果

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Key word : tomato, biofilm, organic hydroponic culture

When tomato cultivated in our organic hydroponic culture (OHC) system, the biofilms (BFs) constructed with its rhizoplane. In the previous study, we discussed to contribute with microbes degrading organic fertilizer (corn steep liquor; CSL) and its nutrients absorption for plants in the BFs. Therefore, the aims of this study are to prove correlation with tomato growth and BFs in OHC. We prepared tomato (*Solanum lycopersidum* cv. "Campri") seedling for 3 weeks and briefly planted for OHC. This study examined on 3 plots to grow tomato added 1) inorganic fertilizer, 2) CSL remained on BFs and 3) CSL removed on BFs. After planted 2-3weeks, the samples collected at the culture solutions and the BFs of 3 plots for each 30 minutes during 3 hours and each an hour after 4 hours when CSL added. The samples analyzed nutrient concentrations (N, P, K) and the bacteria community structures in the BFs. Furthermore, we continued tomato cultivation and researched the tomato yield. In the triplicate pre-test, we had comparison the solutions between 1) and 2) planted after 2-3 weeks, K^+ of 1) declined from 66mg/L to 5.5mg/L, while 2) declined from 44.7mg/L to 13.5mg/L. We considered to absorb K^+ from the solutions synchronous with flowering of first cluster. Tomato roots planted in 2) more developed compare to 1). We suggested that the BFs constructed by OHC advanced for tomato growth.