Development of Disease-customized Probiotics for Infection Control and Inflammation Alleviation

Sang Sun Yoon, Ph.D.

Department of Microbiology and Immunology,
Yonsei University College of Medicine, Seoul 03722, Korea

Abstract:

Indigenous microbes inside the host intestine maintain a complex self-regulating community, providing numerous benefits to their host. We aim to develop two commensal microbial species for medical purposes. First, an *Escherichia coli* strain, we named as 'atypical' *E. coli* (at*Ec*) due to its inability to ferment lactose, is extremely resistant to H_2O_2, a reactive oxygen species (ROS). Whole genome sequencing analysis revealed that the at*Ec* strain possesses a unique catalase gene, responsible for such a strong H_2O_2 removal activity. Intestinal inflammation is known to be accompanied with ROS accumulation. When transplanted into the inflamed intestine, at*Ec* alleviated inflammatory symptoms. Expression of *foxp3* gene was elevated, suggesting that at*Ec* can potentially induce the differentiation of colonic T_{reg} cells in mouse. Second, we uncovered that *Bacteroides vulgatus*, an abundant member of mouse intestinal microbiota, can suppress infection by *Vibrio cholerae*, an important human pathogen. *B. vulgatus*-depleted mice developed cholera-like symptoms when infected with *V. cholerae*; while germ-free mice monoassociated with cultured *B. vulgatus* is significantly more resistant to the infection. Furthermore, *B. vulgatus* cells killed *V. cholerae in vitro*, demonstrating antagonistic relationship between these two species. Together, our results suggest that (i) a commensal microbe with a strong ROS-removing capability has potential to be developed into an inflammation alleviator and (ii) enteric infection is an event that occurs depending on the composition of intestinal microbiota.