Imaging of the interaction between intraluminal probiotics and immune cells in the mouse gut

A Couesnon*[1], N Lhocine[1], N Cerf-Bensussan[2], and R Bourdet-Sicard[3]

[1]IRT BIOASTER – Institut Pasteur de Paris, Lyonbiopôle – 28 rue du Docteur Roux , 75015 Paris, France

[2]Institut IMAGINE – Inserm : UMRS1163, Hôpital Necker - Enfants Malades, Assistance publique - Hôpitaux de Paris (AP-HP), Université Paris V - Paris Descartes – 24 Bvd du Montparnasse, 75014 Paris, France

[3]Danone Research – Groupe DANONE – Avenue de la Vauve, 91767 Palaiseau Cedex France, France

Résumé

During millions of years of co-evolution, symbiotic microbes and their mammalian hosts have developed a mutualistic relationship that guarantees a habitat for the microbes and provides functions that the host does not encode (1-3). In addition, this symbiotic relationship between animal host and microbiota has a significant impact on shaping the immune system locally in the gut and in distant organs and tissues such as the pancreas (4) or the brain (5). Probiotics are defined as live organisms which, when administered in adequate amounts, confer a health benefit to the host (8). Hence products based on probiotics are not only relevant for public health but also provide an interesting market opportunity. Indeed, a fermented product from Danone© containing a probiotic strain was shown to improve protection against common infectious diseases (6, 22). However, the mechanism of translation between the immune system modulation and the systemic effects remains to be characterized, in order to foster the development of new probiotics products for example.
In that respect, the IMMUNOBIOTIC project implemented at BIOASTER aims at generating scientifically robust data to explain how specific probiotics have distal impact on the immune system, and designing new probiotic based products thanks to a better understanding of the target and new strains selection. In particular, it involves studying at steady state the interactions between probiotics and the immune system at the level of cellular immunity in mice with endogenous microbiota.

It has been suggested that probiotics could interact with immune cells in specific area such as Peyer's patches (PPs). The objective is to visualize, in this particular region of the mouse gut, the interactions between fluorescent subsets of immune cells and different fluorescent strains of probiotics selected by Danone Research. For this, we used transgenic mice with dendritic cells (DCs) marked by EGFP expression under the control of the CX3CR1 gene regulatory region, in combination with m-cherry expressing probiotics. Fluorescent bacteria were inoculated into the ligated ileal loop of anesthetized mice and imaged by different microscopic techniques. The challenge was to observe very rare and transient events of bacterial internalization into a very large volume of intestinal tissue, while avoiding potential artefacts due to autofluorescence or spiking with bacteria during sample cutting. Further experiments aim at intravitally imaging bacteria and immune cells in PPs in order to be able to visualize

*Intervenant

very transient phenomena.

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