

## **Deconstructing the Complexity of the Mucus-Bacteria-Soft Matter Gut Microbiome Triangle**

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There is increasing evidence of the correlation between gut health and gut microbiome balance in the immune system and in the prevalence of diabetes, cancer, and neurological disorders related to depression, moods, and sleep. Bacterial fermentation of food substrates and undigested soft matter in colon (e.g., liposomes and nanoemulsions) is extraordinarily complex and call for novel model approaches. These efforts entail understanding how bacterial consortia interact with each other, with the GI mucosa and with components of external environment. Among the key challenges lies the lack of suitable *in vitro* experimental models. This is aggravated by the difficulty to culture most of gut's microbiota (i.e. bacteria) in anaerobic and artificial environments.

This multidisciplinary project will draw on expertise in bionanotechnology approaches combining elements of molecular biology, biopolymers, pharmacy, soft matter and colloids, single-cell microfluidics, and *in silico* modelling to develop a fresh and innovative strategy that will enable to glean an understanding of phenomena that govern the complex behaviour of the colon microbiota.

The aim of the project is to develop a novel approach to deconstruct some of the high spatial-temporal complexity of the human gut microbiota context and uncover some of the key phenomena at play that mediate the interactions between bacteria, their physical environment (i.e., a 3D hydrogel matrix) and engineered soft matter particles.