The Role of Microbiome in Personalized Healthcare

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The link between nutrition and human diseases has always been recognized, but only with modern molecular genetic analysis tools, the role of the gut microbiome including gastrointestinal tract function on neurodegenerative diseases has become obvious. Gut microbiota significantly influences metabolic and immune responses of the host organism, and thus, diet- or infection-related imbalances (dysbiosis) of the gut microbiota disrupt the local and systemic homeostasis and often lead to digestive diseases, such as inflammatory bowel diseases (IBD), type II diabetes, obesity, as well as neurological diseases. The association of the gastrointestinal tract diseases with neurodegenerative diseases, as well as mental and neurological disorders such as depression, anxiety, autism, and schizophrenia has been described. This interaction is called the gut-brain axis and represents one of the most relevant targets for the treatment of IBD and cardiovascular and neurological diseases. One of the most important regulators of this axis is the gut microbiota and its metabolites, which influence brain functions via the immune system, tryptophan metabolism, vagus nerve, and enteric nervous system. We are studying the importance of gut microbiota and their metabolites in immune and glial/microglial reaction in the gastrointestinal tract and central nervous system, to provide valuable insights into the functional potential of the microbiome on the gut-brain axis via specific metabolites. We combine several modern techniques, including molecular manipulations, advanced cellular imaging techniques, and behavioral approaches, to address additional systems-level questions.