Big Investments for Human Microbiome Research

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Major companies on the scene include Second Genome, Enterome, and EpiBiome. In addition, several new startups have entered the field. Amongst the most active investors, Global Engage reports, are Seventure Partners, Flagship Pioneering and BioGaia. In fact there are some 120 companies investing in analyzing data relating to the human microbiome. To take one example, companies such as uBiome are developing genomic tests meant to identify and diagnose harmful microbes in the body.

Investments are also huge. The Wall Street Journal reported in 2018 that “from 2011 through 2015, venture funding in microbiome firms soared 458.5 percent to $114.5 million, while overall venture investment grew 103.4 percent to $75.29 billion. Last year, microbiome investment has surged again despite a decline in overall venture funding. The $616.9 million raised for microbiome companies to date so far in 2016 is more than all of the venture investment in the microbiome space in 2011 through 2015 combined.”The human microbiome relates to the human microbiota, which is the aggregate of microorganisms that resides on or within any of a number of human tissues and biofluids. This includes the skin, mammary glands, placenta, seminal fluid, saliva conjunctiva, gastrointestinal tracts and so on. The organisms include bacteria, archaea, protists, fungi and viruses. The human microbiome is a definition beyond the ‘microbiota’, referring to the collective genomes of resident microorganisms.

The Human Microbiome Project (HMP) was a U.S. National Institutes of Health (NIH) initiative that set the goal of identifying and characterizing the microorganisms which are found in association with both healthy and diseased humans, based on a budget of $115 million. The aim was to inform about human health or disease. Drawing on the wealth of data provided by the HMP, many companies are investing in microbiome based research. As a report in Forbes notes: “Capitalizing on new understanding of how imbalances in this ecosystem contribute to disease, a handful of startups aim to give physicians better weapons to fight conditions such as cancer, autoimmune disorders and infection.”Examples include Vedanta Biosciences Inc, a start-up that has teamed up with New York University Langone Medical Center to study how bacteria can be used in the battle against tumors. Drug delivery is a related area with start-up Blue Turtle Bio utilizing bacteria from the gut microbiome as a drug delivery platform for supplemental enzymes intended to treat enzyme-deficient disease states.

In a separate area, Human Longevity Inc., is putting $220 million into the sequencing of microbiome DNA to uncover disease-associated imbalances in microbial populations. This latter case is aimed at the development of personalized medicines for patients with different conditions. Similarly, Johnson & Johnson is collaborating with a start-up called Second Genome to look for targets for drugs that work by modifying what bacteria live in the intestine with the goal of coming up with new treatments for ulcerative colitis. Research is also governmental: the White House recognized the microbiome's importance (albeit just prior to President Trump assuming office) with an announcement of the National Microbiome Initiative. This is a $221 million investment plan which includes a $100 million investment by the Bill & Melinda Gates Foundation. Some examples of this wave of research and investment include the digitization of the microbiome information (some scientists have termed this “iHMP”). To decode the details of the microbial ecology requires high-resolution genome sequencing feeding into Big Data supercomputers.

One example is with a research team that has taken the important step in modeling the complexity of the human gut’s bacterial communities on the computer, as Pharmaceutical Microbiology Resources reports. The research team hails from the Luxembourg Centre for Systems Biomedicine of the University of Luxembourg. For the project, the researchers gathered all known data on the metabolism of 773 bacterial strains and using these data developed a computer model for each bacterial strain. This collection can now be used with a computer program to simulate metabolic processes with the goal of investigating how the different organisms affect the metabolism of other microbes as well as that of the human host. This generates a series of predictive metabolic models so that diseases can be better understood and disease treatments theoretically tested ahead of drug development. The Luxembourg approach was detailed in the journal *Nature Biotechnology,* with the research paper titled “Generation of genome-scale metabolic reconstructions for 773 members of the human gut microbiota.”