Laura O'Malley
Biology 105
Professor Riley
3/29/18

https://www.broadinstitute.org/news/researchers-find-link-between-microbiome-type-1-diabetes

This comprehensive article describes how researchers from the Broad Institute of MIT and Harvard, Massachusetts General Hospital, and the DIABIMMUNE group followed infants predisposed to Type 1 Diabetes from birth until age three, studying the composition of their microbiome through stool samples.

https://bmcmedicine.biomedcentral.com/articles/10.1186/1741-7015-11-46

This presented a detailed study which found that the microbiome of children with type one diabetes is drastically different than with healthy children. Most notable were the differences in amounts of Bifidobacterium, Lactobacillus, and Clostridium, as well as lactic acid-producing bacteria, butyrate-producing bacteria and mucin-degrading bacteria.

https://onlinelibrary.wiley.com/doi/full/10.1111/cei.12321

This article examines previous studies related to the human microbiome and its role in the development of type 1 diabetes and expresses a need for more data to be collected for specific purposes.

Laura O'Malley
Biology 105
Professor Riley
3/29/18

The Relationship between the Microbiome and Type 1 Diabetes

As discussed in lectures, the microbiome has a significant impact on the health of individuals. It can also be related to the overall health of the immune system. Type 1 Diabetes is an autoimmune disease "resulting from an immune-mediated destruction of pancreatic beta cells in genetically predisposed individuals" (Dunne, J. L., et al). With the relatively new knowledge surrounding the impact of the microbiome on the immune system, inquiries have been made into the role of the microbiome in immune related diseases such as diabetes.

Significantly, there is a noticeable difference between the microbiome of healthy and diabetic individuals. The Broad institute notes that "While most bugs in our microbiome are harmless, and even beneficial, changes in the microbiome (and in the interactions microbial species share with their human hosts) have been linked to various disease states" (Broad Institute). This article also talks about a study led by Ramnik Xavier, which followed 33 subjects who were genetically predisposed for diabetes from birth until age 3. They would measure the microbial diversity, and noted that of the subjects that developed diabetes, there was a "25% drop in community diversity (in other words, in the number of distinct species present in the microbiome) one year prior to the onset of the disease" (Broad Institute).

This variance from what could be considered a healthy or normal microbiome was also studied in "Gut microbiota in children with type 1 diabetes differs from that in healthy children: a case-control study". This research article pointed out that "type 1 diabetes is associated with compositional changes in gut microbiota… significant differences in the number of Bifidobacterium, Lactobacillus and Clostridium and in the Firmicutes to Bacteroidetes ratio ...the quantity of bacteria essential to maintain gut integrity was significantly lower in the children with diabetes than the healthy children." (Murri, Mora, et al). This is remarkable because it is a study that is beginning to identify and isolate the microbes directly linked with the specific disease.

The immune systems involvement in the development of diabetes was mentioned in "The intestinal microbiome in type 1 diabetes". This article cites studies which have proved that "Rederivation of NOD [Non Obese Diabetic] mice from conventional to a specific pathogen-free (SPF) setting increased diabetes incidence, suggesting that some microbial exposures may protect against T1D 28. Moreover, experimental exposure to bacterial antigens and infections decreases the risk for T1D in the NOD model 29" (Dunne, J. L., et al). This plays into the hygiene hypothesis discussed in lecture. Mice who were put into a sterile environment, where they would not encounter pathogens and therefore would not build their immune systems and become predisposed to heightened immune sensitivity, were more likely to develop diabetes. Also in favor of this hypothesis, mice who were exposed to specific pathogens had a decreased likelihood of developing the disease.

There is an understanding in the scientific community that the microbiome and diabetes are linked. Exactly how, and to what extent, however, is not so clear. "The intestinal microbiome

in type 1 diabetes" makes a point that "unravelling the contribution of the microbiome in T1D development may prove especially difficult" (Dunne, J. L., et al.). So, while we know some specifics about how this link functions, its exact mechanisms are not yet understood. While this link shows promise for better and earlier methods of diagnosis and potentially even treatment, it is not yet clear how.

Laura O'Malley
Biology 105
Professor Riley
3/29/18

Works Cited

Dunne, J. L., et al. "The Intestinal Microbiome in Type 1 Diabetes." *Clinical & Experimental Immunology*, Wiley/Blackwell (10.1111), 9 June 2014, onlinelibrary.wiley.com/doi/full/10.1111/cei.12321.

Murri, Mora, et al. "Gut Microbiota in Children with Type 1 Diabetes Differs from That in Healthy Children: a Case-Control Study." *BMC Medicine*, BioMed Central, 21 Feb. 2013, bmcmedicine.biomedcentral.com/articles/10.1186/1741-7015-11-46.

"Researchers Find Link between Microbiome, Type 1 Diabetes." *Broad Institute*, Broad Institute , 24 June 2016, www.broadinstitute.org/news/researchers-find-link-between-microbiome-type-1-diabetes.