

AI in Focus: the Human Microbiome

October 6, 2021

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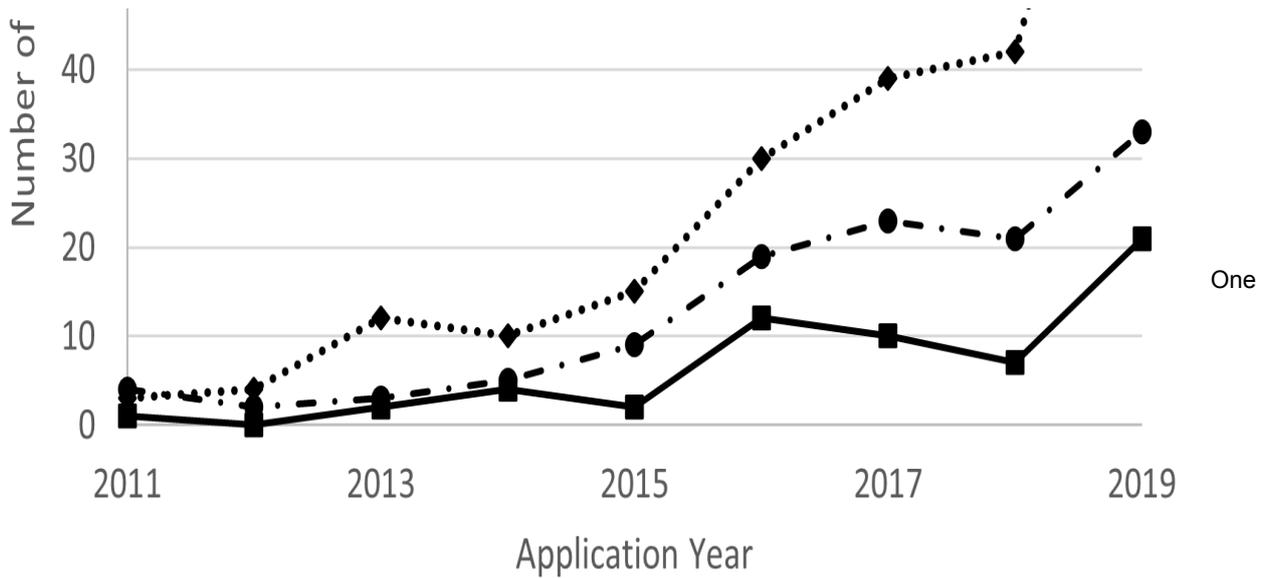
It is estimated that roughly 39 trillion bacteria live in and on our body – more than the estimated 30 trillion human cells that make up the human body. The implications of these organisms on our health have been under intensive research in the last decade. For example, the gut microbiota has been linked to diverse diseases and conditions such as Type 2 diabetes, irritable bowel syndrome (IBS), and neuropsychiatric conditions, through the interaction between microbiota metabolites and the host. The skin microbiota is implicated in inflammatory skin diseases.^[2]

Understanding of the role of microbiota on human health relies on our ability to measure and characterize the human microbiome, which typically involves 16S rRNA amplicon sequencing or shotgun metagenome sequencing. The advance in high-throughput sequencing technologies means obtaining data from a large number of samples is no longer a limiting factor. However, analysis and interpretation of the vast amount of data generated by these sequencing technologies remains a challenge. AI tools have been employed to address many of these challenges (cite AI and genomics article, if published). In the area of microbiome, for example, machine learning has been used in microbial classification to investigate association with certain conditions/diseases. Another active area of microbiome research is to integrate data from multi-omic approaches, including metagenomic, metatranscriptomics, metaproteomics and metametabolomics, to attempt to fill mechanistic gaps.^[4]

Patent trends can be used to provide insights into commercial activities in specific fields or sectors. An analysis of patent filings relating to AI and microbiome shows that in the US, the number of patent applications yearly has more than doubled since 2015 (Figure 1). Canada and Europe have seen a smaller level of increase during that period, but still a strong overall upward trend. We anticipate the trend to continue as companies continue to find innovative solutions to meet unmet needs in health management.

Figure 1. Application trend





category of patent applications relating to AI and microbiome is directed to the classification of patients with the same disease/disorder, but different symptoms/disease manifestations based on patient microbiome profiles using AI tools. Such inventions can lead to new diagnostic tools and personalized treatment options, thereby improving health outcome. An example of such an invention is described in the Canadian patent application No. 3,101,541, which is directed to a method of stratifying patients with IBS using AI tools.

In Canada, recent developments in patent law have the potential to provide a more favorable environment for patenting of these technologies. Specifically, *Yves Choueifaty v Attorney General of Canada* [6] and the resulting practice notice on patentable subject matter issued by CIPO are improving the chances that medical diagnostic methods are considered to be patentable subject matter in Canada.^[7]

This has been the eighth article in our *AI in Focus* series. You can read the first seven articles here:

- [AI in Focus – Autonomous Vehicles](#)
- [AI in Focus – Fundamental Artificial Intelligence and Video Games](#)
- [AI in Focus – Robotics](#)
- [AI in Focus – Natural Language Processing](#)
- [AI in Focus – BlueDot and the Response to COVID-19](#)
- [AI in Focus – Image Recognition](#)
- [AI in Focus – Genomics](#)

If you have any ideas for other topics that you would like us to cover in our next article in this series, please email [Isi Caulder](mailto:lsi@bereskinparr.com), Co-Leader of the Artificial Intelligence (AI) practice group at Bereskin & Parr LLP.

[1] See e.g. <https://pubmed.ncbi.nlm.nih.gov/32652044/>,
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7532639/>,
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7698457/>

[2] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6125946/>

[3] See e.g. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387146/>,



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3912131/>

[4] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6898977/>;

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4800835/>

[5] We analyzed patent application trends using the PatSnap® database and a search strategy that was adapted from WIPO Technology Trends 2019 Artificial Intelligence (https://www.wipo.int/export/sites/www/tech_trends/en/artificial_intelligence/docs/techtrends_ai_methodology.pdf)

[6] <https://www.canlii.org/en/ca/ct/doc/2020/2020fc837/2020fc837.html?resultIndex=1>

[7] <https://www.bereskinparr.com/doc/the-canadian-patent-office-releases-new-guidelines-the-diagnostics-industry-should-be-cautiously-op>

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