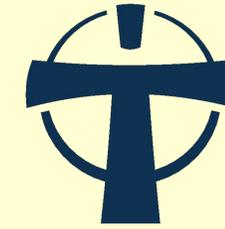


Utilizing Gut Microbes to Promote Faster Lung Tissue Repair for COVID-19 Patients

Danielle Childers, Franciscan University

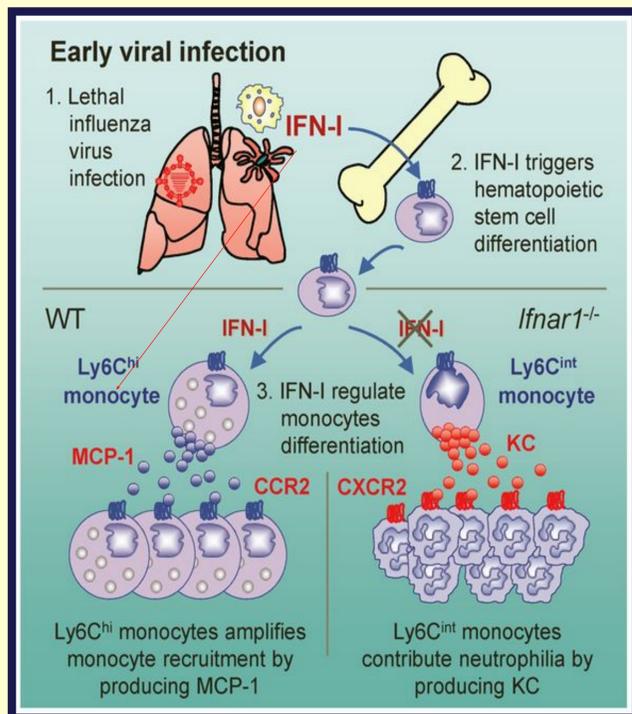


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Introduction & Background

Did you know that your gut microbes are talking to your bones?? Some gut microbes cross-talk with our bone marrow, causing new immune cell production. COVID-19 is a newly developed infectious disease caused by SARS-CoV-2 virus, which ultimately affects the lungs. Intriguingly, there are many asymptomatic cases of COVID-19 whereas others result in severe symptoms or mortality. **If the gut can have an effect on immune response, then asymptomatic patients may have a particular gut microbe which is aiding them in an advanced recovery via cross talk.** Some *Firmicutes* species have been shown to increase Helper T17 Cells and LY6C monocyte proliferation. It is unknown how consistent this effect is and it has only been tested in mice. **The purpose of this proposal is to seek a consistent microbe which is aiding asymptomatic patients in immune response.** If discovered, new probiotics/prebiotics would serve as natural and targeted immune cell enhancements.

SCFA's can increase in LY6C Monocytes

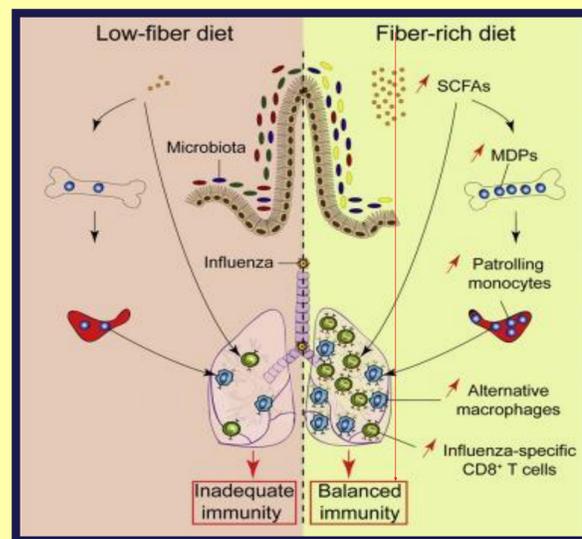


Example of gut-bone cross-talk. SCFA's produced by Firmicutes can increase LY6C. The LY6C monocytes promote faster recovery from lung infections by repairing lung tissue.

Experimental Approach

AIM 1: Fecal samples of 40 voluntary COVID-19 patients will be examined (20 asymptomatic/20 symptomatic) via OMNIgene tool kit. Samples will be analyzed and compared in hopes of discovering a high prevalence of *Firmicutes* in asymptomatic patients and a low prevalence in symptomatic patients. The samples will have a **DNA analysis to determine gut microbial population.** If a microbe is correlated between the asymptomatic patients then the next step is to test the effects on immune cells when increasing this microbe in the human gut.

Increasing SCFA's may repair Immunity



This image shows how fiber (promoting *Firmicutes* species) signals immune cells to repair lungs during an infection.

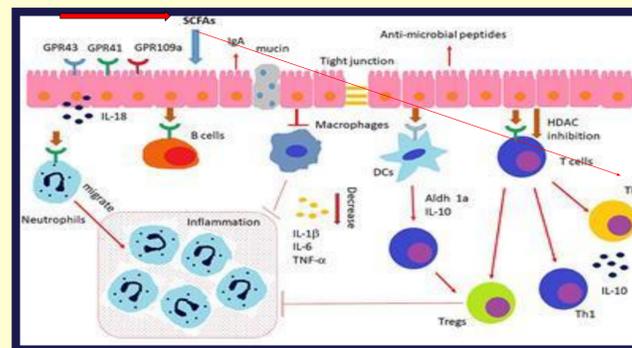
AIM 2: The same 40 patients will have a small blood sample taken to **measure the immune cells present before increasing *Firmicutes*.** The first step is to measure TH17, Ly6C monocyte and *Firmicutes* abundance prior to increasing *Firmicutes*. Performing this requires a blood sample in order to measure immune cells present. TH17 serum levels can be quantitated by lymphocyte isolation. Ly6C monocytes can be isolated and measured by Cytometry analysis. After data is collected, the participants will be given a **high fiber/low animal fat/protein diet for 6 months to increase *Firmicutes* gut colonization.** After this, **another fecal and blood sample will be taken to observe change in immune response.** Observation of an increase in immune cells can lead to **new medicinal probiotics/prebiotics.**

Expected Results

Aim1 Expected Results - We expect that asymptomatic patients will have a higher presence of Firmicutes population in their fecal samples compared to those who are at risk or who are experiencing symptoms from COVID-19.

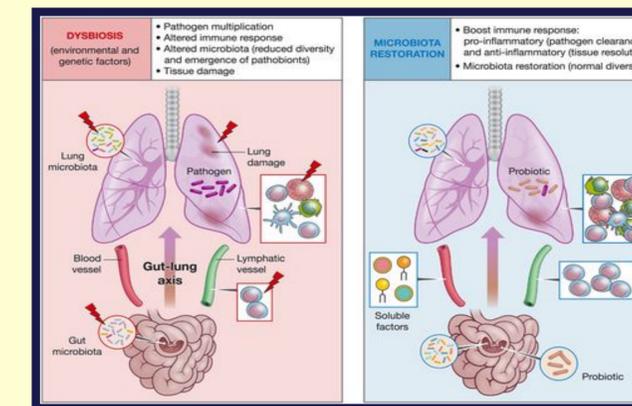
Aim 2 Expected Results -After a 6-month diet of high fiber, we expect to see a significant increase in *Firmicutes* gut colonization. From this, we also expect to see an increase in Ly6C monocytes, Th17 cells and white blood cells after increasing *Firmicutes* gut microbiota through dietary fiber intake. This will show us if increasing certain microbes can serve as a medicinal-like treatment for lung tissue repair by manipulating immune response.

SCFA's Promote Help T-17 Cell Proliferation



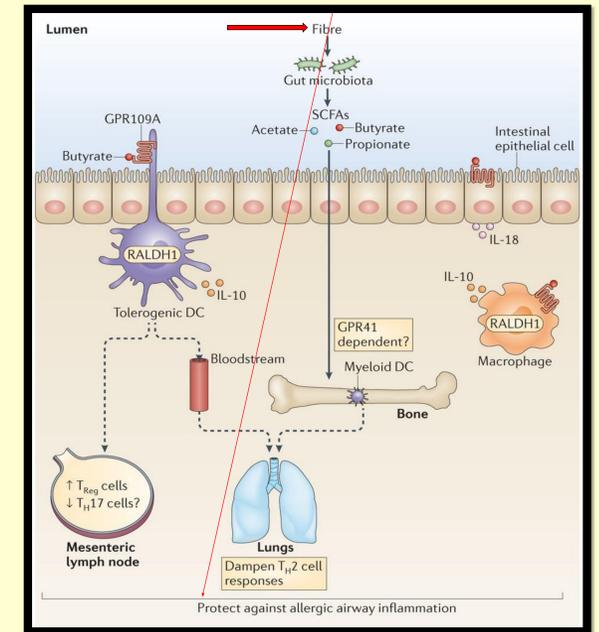
Helper T-17 cells increase the recruitment of white blood cells to airways during infection.

Gut Microbes may Positively Effect Lung Health



This image is showing the difference between an unhealthy gut microbiome (left) vs a healthy gut microbiota (right).

Microbes Could Serve as Targeted Immune Cell Responses



Fiber increases Firmicutes gut microbiota that produce SCFA'S which trigger a cascade of signaling events leading to unique immune responses, such as lung tissue repair.

Conclusion

- *Firmicutes* produce SCFA's
- SCFA's cross-talk to immune cells, causing a response
- SCFA's produced by Firmicutes have shown an effect on LY6C Monocytes and TH17.
- LY6C Monocytes promote lung tissue repair and TH17 increase white blood cells.
- Asymptomatic COVID-19 patients may have a beneficial gut microbe aiding in their immune response, such as Firmicutes and by examining the gut, we can determine this.
- If discovered, this microbe can be cloned and used as targeted immune cell probiotics.
- This can serve as COVID-19 prevention and aid in lung recovery and the future of probiotics could be much brighter.

References

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