Weill Cornell Medicine

Microbiome-Derived Therapies for Treatment and Prevention of Viral Infections

Lead Inventor:

Ria Goswami, Ph.D.

Assistant Professor of Virology in Pediatrics, Weill Cornell Medical College

Business Development Contact:

Jamie Brisbois

Manager, Business Development and Licensing

(646) 962-7049

jamie.brisbois@cornell.edu

Microbiome-Derived Therapies for Treatment and Prevention of Viral Infections

Background & Unmet Need

- There are few antivirals for many viral infections including SARS-CoV-2, influenza, Zika, and CMV
- Limited access to antiretroviral therapy (ART) underlies most new HIV infections and HIV-related deaths
- Barriers to ART and other antivirals include toxicity, side effects, financial constraints, and lack of access to medical care
- There are few broad-spectrum antivirals, which would have the capacity to treat several different viruses
- **Unmet Need**: Development of novel antiviral strategies to overcome the lack of effective treatments, toxicity of current ARTs, and barriers to medicine for viral infections

Technology Overview

- **The Technology:** Methods of preventing viral infection, including HIV or CMV, using an aryl hydrocarbon receptor (AhR) agonist or *Lachnospriaceae* family bacteria
- **The Discovery:** *Lachnospriaceae* family members *Clostridium immunis (C. immunis)* and *Ruminococcus gnavus* (*R. gnavus*) metabolize tryptophan into 3-indolelactic acid (3-ILA) via Aromatic Amino Acid Aminotransferase (ArAT)
- 3-ILA and FICZ (an alternative agonist) can prevent HIV infection by binding to aryl hydrocarbon receptor (AhR)
- **PoC Data:** Administration of *C. immunis* as a live biotherapeutic suppresses active HIV replication by up to 80-90% *in vitro* in an ArAT dependent manner
- Administration of FICZ suppresses active HIV replication by up to 50% *in vitro*

Inventors:
Ria Goswami
Neeraj Surana
Danting Jiang
Chin Yee Tan

Patents:
Provisional Filed

Publications:
N/A

Biz Dev Contact:
Jamie Brisbois
(646) 962-7049
jamie.brisbois@cornell.edu

Cornell Reference:
D-10621

Weill Cornell Medicine

ART: Antiretroviral therapy
AhR: Aryl hydrocarbon receptor
ArAT: Aromatic Amino Acid Aminotransferase

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Technology Applications

- Use of small molecule AhR agonists or *Lachnospriaceae* live biotherapeutics to prevent HIV infection in infants who breast-feed from HIV-positive mothers
- Prevention or treatment of other viral infections including HIV, CMV, and potentially SARS-CoV-2, influenza, Hepatitis C, and Zika

Technology Advantages

- AhR agonists or *Lachnospriaceae* bacteria are broad-spectrum and can be used for co-infections
- Prolonged colonization of *Lachnospriaceae* in patients can prevent the need for re-dosing
- AhR agonists or *Lachnospriaceae* can be used as a monotherapy, rather than in combination like ARTs
- May overcome the toxicity of current ART regimens

Supporting Data / Figures

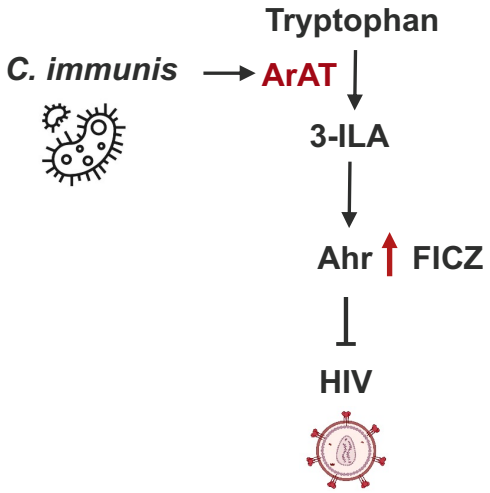

Figure 1: Schematic of HIV inhibition by *C. immunis*. *C. immunis* prevents HIV infection by expressing ArAT, which produces, 3-ILA, which activates Ahr.

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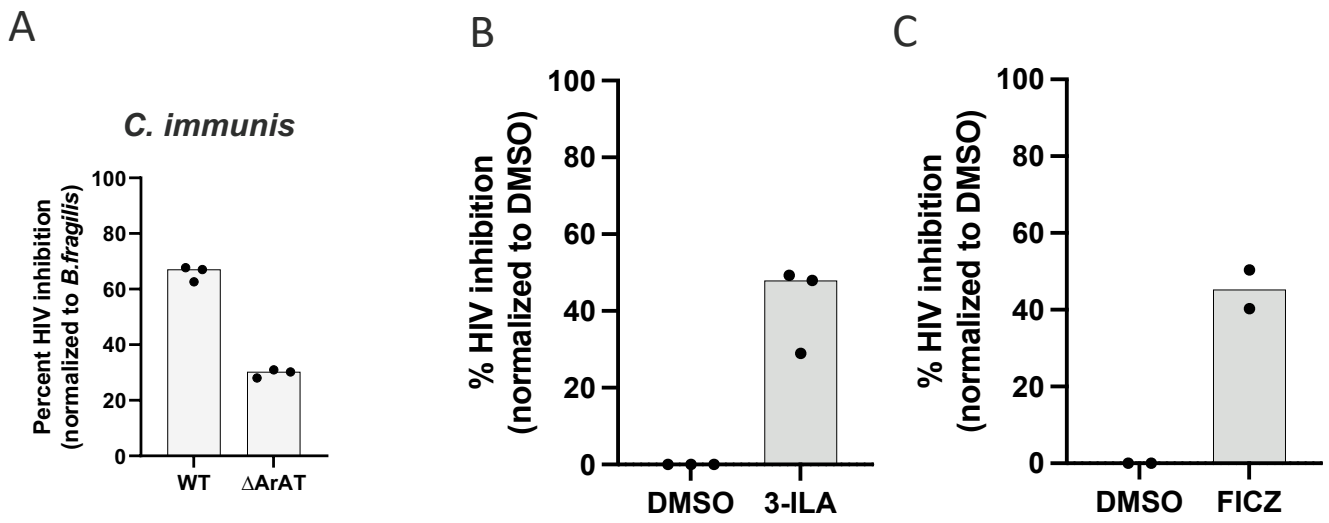

Figure 1: a) *C. immunis* prevents HIV infection in an ArAT-dependent manner. **b)** 3-ILA alone can prevent HIV infection **c)** aryl hydrocarbon receptor (3-ILA target) agonist, FICZ can prevent HIV infection.

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