



Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

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Title of Project: Glycopeptidolipids: A New Diagnostic tool for COPD and Cystic Fibrosis patients infected with Non-Tuberculous Mycobacteria

Finalist's Name: Ria Rajasekharan

School and City: Fossil Ridge High School, Fort Collins

Sponsor's Name: Vishnu Rajasekharan

Category: Micro & Molecular Biology

Division: Senior (grades 9 - 12)

Abstract (250 words or less):

This project explores the role of Glycopeptidolipids (GPLs) as a diagnostic tool in the timely detection of Non-Tuberculous Mycobacterial (NTM) infections, especially in people with Cystic Fibrosis (pwCF). Concerns among pwCF about the challenges of diagnosing NTM infections are widespread. As it stands, Lipoarabinomannan (LAM) is established as a biomarker for active tuberculosis and has been reported in pwCF to have detectable amounts in urine. The aim of this project was to look for a biomarker other than LAM, that would be present in detectable amounts in non-sputum patient samples, (it is difficult to produce large amounts of sputum on a regular basis) and thus be used to diagnose NTM infections in CF patients. This project studied the differences in GPLs, highly antigenic glycolipids, that were present in several species of NTMs in both smooth (S) and rough (R) morphotypes of *Mycobacterium abscessus*, an NTM known for causing respiratory infections in pwCF. The S morphotype, with high GPL production, aids in biofilm formation and immune evasion. The R morphotype, with low GPL production, is associated with increased virulence and severe infections.

GPLs were purified from in-vitro grown *M.abscessus* smooth and rough morphotypes, analyzed on thin layer chromatography (TLC) for differences, analyzed by Gas Chromatography- Mass Spectrometry (GC-MS) after an alditol-acetate derivatization, and further validated on spiked samples where urine from a healthy volunteer with known amounts of GPL and analyzed on GC-MS once more. The goal of this study is to quantitate the amount of GPLs present in urine of a pwCF with NTM infection and to eventually test the sensitivity of a positive urine GPL to predict a new positive NTM sputum culture.

Overall, this project aims to pave the way for the development of reliable diagnostic tool to detect or predict NTM infection caused by *M.abscessus* complex (MABSC).

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature:

Date:

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. **A signed copy of this form must be included in your notebook.**