



Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: The Effects of L-Dopa on Probiotic Bacterium

Finalist's Name: Grace Xue

School and City: Fairview High School, Boulder

Sponsor's Name: Graham Redweik

Category: Micro & Molecular Biology

Division: Senior (grades 9 - 12)

Abstract (250 words or less):

Human intestinal tract contains a diverse community of trillions of bacteria, known as the gut microbiome, that can have a dramatic impact on human health and diseases (Thursby and Juge 2017; Morais et al 2021), including neurodegenerative diseases such as Parkinson's disease (PD). To alleviate their illness, PD patients primarily receive the drug L-Dopa, a metabolic precursor to dopamine, to replenish the natural stores of dopamine in the body to reduce symptoms (Nagatsu 2009). Bacteria are affected by host neurochemicals, which can influence important properties of bacteria, including biofilm formation, ion intake, bacterial growth, immune resistance, and pathogenicity. For example, catecholamines, a group of neurohormones, have been shown to exponentially increase growth of Escherichia Coli (Barandouzi, 2022; Freestone et. al 2002). However, it is unclear how L-Dopa, a catecholamine precursor, might impact the growth and metabolic activities of gut bacteria, which may have major implications for the composition of gut microbiome and, by extension, neurodegenerative pathologies in PD patients. I employed three different tests (a growth test, a biofilm test, and a siderophore test) to examine the effects of L-dopa on two common probiotics, Escherichia Coli Nissle 1917 (EcN) and Lactobacillus Rhamnosus. I found that EcN grew significantly more after being treated with L-dopa, formed more biofilms, and produced more siderophores to intake ions. Lactobacillus also grew more, but to a lesser extent. My results show that EcN's probiotic activity can be enhanced by L-Dopa. Since EcN can help with PD treatment, this could provide for novel treatment methods.

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.**