



## 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 Effect of Glyphosate on Bacillus subtilis Biofilm

Finalist's Name: Serene Park

School and City: Cherry Creek High School, Greenwood Village

Sponsor's Name: Ethan Dusto

Category: Micro & Molecular Biology

Division: Senior (grades 9 - 12)

Abstract (250 words or less):

Currently, there has been research on the impacts of glyphosate on cell viability, soil biodiversity, and antibiotic biocontrol in relation to Bacillus subtilis as well as the effect of different temperatures, pH, heavy metals, and pesticides on their biofilm formation. However, the effects of the herbicide glyphosate on Bacillus subtilis, specifically its biofilm-forming mechanism, have not been studied. Bacillus subtilis is a bacteria species that is well known for its social behavior of creating biofilms when under stress to increase protection. A mutualistic relationship has been studied between plants and Bacillus subtilis, where the bacteria forms a biofilm around plant roots to protect them from pathogens. Glyphosate is one of the most commonly used herbicides in the United States and its potentially harmful impact on microorganisms in the soil as a nonselective herbicide has been widely contested. This study, through the use of the crystal violet assay, was able to quantify a significant decrease in B. subtilis biofilm mass with the addition of glyphosate as well as a change in the biofilm formation mechanism. While the purpose of the herbicide is to kill non-glyphosate-resistant weeds, our crops still rely on these biofilms, thus glyphosate's repressive effects on Bacillus subtilis biofilm could have serious implications for crop health. This could also have implications for the agricultural industry as well as for the testing of newly made herbicides to determine their full ecological impact via their effect on the soil microbiome.

*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.**