View results

Respondent
4 Quanhui Ye

37:15
Time to complete

ACKNOWLEDGMENT

1

Please read and acknowledge the following:

- SSC funding can take ****1 MONTH OR LONGER**** to receive after the SSC has voted to approve a project because it includes several steps:
  - the authorization of an award letter by SSC, iSEE, Division of Student Affairs, the project's advisor *(student-led projects only)*, and the project lead;
  - the creation of the CFOP by the project team's departmental financial contact in conjunction with the project team;
  - the transfer of funds from SSC to the project's CFOP.
- If you are a project lead for a new project that is approved by the SSC, be sure to check your email regularly for the prompt to sign the award letter to help facilitate the efficiency of the process.
- Project teams for funded SSC projects do NOT receive funds directly. After a project's SSC funds have been transferred to the project's CFOP, the project team must work with the sponsoring department to purchase the approved budgeted items on behalf of the project team.
- This application will be shared publicly on our SSC Illinois Climate Action Plan (iCAP) portal so that others can learn from your project.
- Funded projects have grant reporting requirements. See our website for more information.

*

◉ I acknowledge that I have read this information.

APPLICATION INSTRUCTIONS

Prior to starting your application, make sure you have the following information available:

- Project personnel including project lead, confirmed faculty/staff advisor ***(student-led projects only)***, departmental financial contact, other team members
- Working Group attendance information
- Project title and abstract
- Project description including timelines, deliverables, detailed description about the project, project feasibility information
- Intended student impacts
- Intended sustainability impacts
- Optional supporting documentation (e.g., Working Group presentation, letters of support)
- Detailed project budget information
- Information about changes to the Step 2 application submitted compared to the Step 1 application submitted

See our website for a sample application: https://studentengagement.illinois.edu/studentsustainability/illinoisgreenfund/funding

2

Today's Date *

4/17/2025

3

A follow up project presentation at a SSC Working Group meeting is *occasionally* requested of a project team prior to submitting their Step 2 application. Did someone from the project team present updates to their originally proposed Step 1 project at a SSC Working Group meeting this semester?

*

○ YES

◉ NO

4

What is the name of your project? *

Engineered renewable nuclease biocatalyst for degradation of antibiotic resistance genes from wastewater

5

Amount of funding requested from the SSC for this project *

The amount entered here must match the amount reflected in your detailed primary budget spreadsheet that you will be prompted to submit with this application.

$13848

PROJECT DESCRIPTION

6

Project Category *

- ○ Education & Justice
- ○ Energy
- ○ Food & Waste
- ◉ Land, Air & Water
- ○ Transportation & Infrastructure

7

Project Abstract *

In approximately 100 words, describe your project.

Antimicrobial resistance (AMR) is a global health crisis, driven by the spread of antibiotic resistance genes (ARGs) in the environment. Current ARG removal methods are inefficient, energy-intensive, and generate harmful byproducts. This project aims to develop a renewable biocatalyst to degrade ARGs from municipal wastewater, reducing the spread of antibiotic-resistant pathogens. Beyond research, we will engage students through undergraduate research symposia and guest lecture, enhancing awareness of AMR and sustainability on campus. By integrating biotechnology with environmental engineering, this initiative advances sustainable solutions to a critical public health challenge while enriching student education through hands-on, research-driven experiences.

8

What key changes are reflected in your Step 2 application compared to your Step 1 application, if any, and why? *

I've given thorough consideration to recycling and reusing lab materials to enhance sustainability—please see the detailed notes in the budget form. Additionally, I've included an alternative budget option for your review.

9

Describe your project in detail. Ensure the SSC has sufficient details to be able to evaluate the merits and feasibility of this project. *

Be sure to address the following:
-What are your project's goals and how do you intend to accomplish them?
-What are your project's deliverables?

Background & Motivation: Antimicrobial resistance (AMR) is a global public health crisis, responsible for 1.27 million deaths in 2019. While AMR naturally evolves, its rapid spread is largely driven by the proliferation of antibiotic resistance genes (ARGs). Studies have shown that extracellular ARGs play a crucial role in the environmental spread of AMR. Current wastewater treatment methods, including chemical disinfectants, UV irradiation, and advanced oxidation, have significant limitations such as low efficiency, high energy/chemical inputs, and generation of harmful byproducts. Therefore, there is an urgent need to develop innovative and sustainable technologies to effectively remove ARGs and curb their environmental transmission.
Project Goal: This project aims to develop a renewable, surface–displayed biocatalyst to degrade extracellular ARGs in municipal wastewater. It offers an energy-efficient, sustainable approach to mitigating AMR and protecting public health. Two undergraduate students—one from Department of Chemical & Biomolecular Engineering and one from School of Molecular & Cellular Biology—will receive hands-on interdisciplinary training in molecular biology and environmental engineering. Findings will be presented at the 2026 Undergraduate Research Symposium for academical engagement and knowledge dissemination, and the project lead will deliver guest lectures in courses like CEE 538, increasing awareness of AMR challenges and sustainable solutions.
Approach: Nuclease enzymes from different microbial sources (e.g., Bacillus licheniformis) will be displayed on Saccharomyces cerevisiae cell surface using the a-agglutinin anchoring system. The enzyme will be expressed from a GAL1-controlled recombinant plasmid and immobilized via covalent disulfide bonds to ensure stability. Nuclease mutants may be explored for improved enzyme activity and robustness. The biocatalyst's activity will be assessed under varying pH, temperature, dosage, and reaction time to determine optimal conditions for ARG degradation. Addtionally, the biocatalyst's efficacy will be evaluated in real-world secondary wastewater effluent from local treatment plants. Performance will be tested across different dosages and reaction times, along with its reusability and renewability.
Deliverables: 1) Development and optimization of a novel biocatalyst for ARG degradation in wastewater, generating fundamental data for sustainable wastewater treatment. 2) Two undergraduate researchers will gain valuable experience in molecular biology, environmental sustainability, experimental design, data analysis, and scientific communication and writing. 3) Results will be presented at the UIUC Undergraduate Research Symposium, and guest lectures will contribute to educating students on AMR and sustainable water treatment solutions.

10

List your proposed project's timeline and major milestones. *

NOTE: SSC funding agreements remain active for two years. Thus, your timeline should reflect your activities over a two year period or less.

June-August 2025
- Order genes and reagents for constructing the plasmids
- Molecular cloning and sequencing

August-December 2025
- Plasmid transformation into host yeast to express the target protein and generate the biocatalyst
- Activity and immunofluorescence characterizations of the biocatalyst
- Screening more enzyme candidates (if needed)
- Robustness evaluation of the biocatalyst and create more robust mutants if needed
- Submit the project progress report

January-May 2026
- Comprehensive characterization and optimization of the biocatalytic properties of the biocatalyst
- Evaluate and optimize the use of the biocatalyst for degrading antibiotic resistance genes in real-world secondary wastewater effluent
- Register and attend undergraduate research symposium and deliver a guest lecture to engage more undergraduate and graduate students
- Submit the final project report

11

Have you spoken with anyone in UIUC's Facilities & Services (F&S) department regarding the feasibility of your project? *

NOTE: While this step is optional for many projects, all projects involving infrastructure (e.g., internal or external physical infrastructure of university buildings, etc.) or grounds (e.g., plantings, installing structures on campus grounds, etc.) must have F&S approval prior to receiving SSC funding. If you need assistance evaluating the feasibility of your proposed project, please reach out to SSC-Advisor@illinois.edu PRIOR to submitting your application.

- ○ YES
- ○ NOT YET
- ◉ N/A

STUDENT IMPACTS

12

How many students will be directly impacted by this project? *

This research-based project will offer hands-on learning and interdisciplinary mentorship to two undergraduate students.

13

How many students will be indirectly impacted by this project? *

This project will reach hundreds of undergraduate and graduate students through the Undergraduate Research Symposium presentation, guest lectures, written reports, and journal publication.

14

What is the intended student impact? *

Be sure to address the following:
-How will this project benefit students?
-How will students be involved with this project?
-What educational components are in your project?

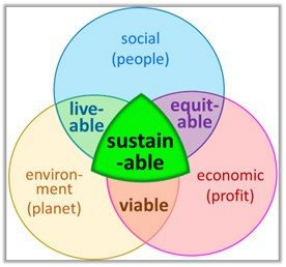
This research-driven project will provide hands-on training and interdisciplinary mentorship to two highly motivated undergraduate students from different departments at UIUC. Through active participation in literature review, experimental design, lab work, data analysis, scientific writing, and presentations, they will develop critical research and professional skills essential for their academic and career growth.
Beyond direct mentorship, the students will present their findings at the UIUC Undergraduate Research Symposium, gaining valuable experience in scientific communication. Additionally, the project lead will deliver guest lectures, raising awareness among undergraduate and graduate students about antibiotic resistance challenges and sustainable water treatment solutions. By integrating cutting-edge research with education, this project will not only provide students with meaningful learning experiences but also contribute to campus sustainability efforts and the advancement of environmentally friendly wastewater treatment technologies.

SUSTAINABILITY IMPACTS

15

Authentic sustainability consists of the overlapping area of 3 spheres: Environment, Society, and Economy.

Describe how your project addresses sustainability. *



This project will advance sustainability by addressing environmental, societal, and economic challenges associated with antibiotic resistance and wastewater treatment:
1) Environmental sustainability: The rapid spread of antibiotic resistance, driven by extracellular antibiotic resistance genes (ARGs) in the environment, demands effective and eco-friendly mitigation strategies. Wastewater treatment plants serve as major reservoirs for ARGs, yet conventional treatment methods fail to degrade them effectively. This project aims to develop a renewable biocatalyst capable of enzymatically eliminating extracellular ARGs, providing a sustainable and efficient solution to combat antibiotic resistance while promoting cleaner water and public health.
2) Societal impact: The project will enhance student education and public awareness of antibiotic resistance and sustainable wastewater treatment. Findings will be shared through project reports, symposium presentation, guest lectures, and publications, engaging undergraduate and graduate students in discussions on critical public health challenge related to antimicrobial resistance as well as innovative biotechnological solutions.
3) Economic benefits: Compared to conventional disinfection methods such as chlorination, ozonation, UV irradiation, and advanced oxidation processes, which are chemically intensive and non-selective, the biocatalyst from this project offers a targeted, energy-efficient approach to ARG degradation. Operating under ambient conditions, it reduces reliance on costly chemicals and high-energy treatments. Additionally, the surface-displayed enzyme design enhances stability and reusability, allowing for easy regeneration through microbial cultivation. This eliminates the need for costly protein purification, making the biocatalyst production scalable, cost-effective, and practical for real-world wastewater treatment applications.

16

How does your project promote and increase environmental stewardship at UIUC? *

If applicable, also address what the carbon, water, waste, and/or energy savings is associated with your project.

This project promotes and enhances environmental stewardship at UIUC by advancing sustainable wastewater treatment solutions, fostering student engagement in environmental research, and raising awareness of antibiotic resistance as a critical public health. By developing a renewable biocatalyst to enzymatically degrade antibiotic resistance genes (ARGs) in wastewater, this project aligns with UIUC's commitment to sustainability by reducing environmental contamination and promoting safe water reuse.
Additionally, this project will directly involve undergraduate students in hands-on sustainability research, equipping them with valuable skills in molecular biology and environmental biotechnology. Through presentations at the Undergraduate Research Symposium and guest lectures in relevant courses, the project will educate a broader audience on the importance of sustainable water treatment strategies, inspiring more students to engage in environmental stewardship initiatives.

17

Does your project aim to advance one or more of the Illinois Climate Action Plan's (iCAP) objectives? If so, indicate which and describe how. If not, enter N/A.

A full list can be found here: https://icap.sustainability.illinois.edu/objectives

This project aligns with the iCAP objective: 6.1 Broaden Sustainability Education

PROJECT LEAD

18

Project Lead's Full Name *

Quanhui Ye

19

Project Lead's Department *

Institute for Sustainability, Energy, and Environment

20

Project Lead's University Email Address *

quanhui2@illinois.edu

21

The Project Lead must be a UIUC faculty, staff, or currently enrolled student. Which category describes the Project Lead's primary role at the university? *

- ○ Currently enrolled UIUC student
- ○ UIUC faculty
- ◉ UIUC staff

PROJECT'S FINANCIAL CONTACT

The project's Financial Contact must be a full-time Illinois employee who has the authority to make university purchases, manage the project's financials, and generate financial reports on behalf of the project.

22

Financial Contact's Full Name *

Elizabeth Murphy

23

Financial Contact's Department *

Institute for Sustainability, Energy, and Environment

24

Financial Contact's University Email Address *

eamurphy@illinois.edu

25

Are there additional members of your project team? *

- ◉ YES
- ○ NO

ADDITIONAL TEAM MEMBER

26

Team Member's Full Name:

Katherine Haejin Park

27

Team Member's Department/Campus Affiliation:

Department of Chemical and Biomolecular Engineering

28

Team Member's University Email Address:

kpark92@illinois.edu

29

Do you have additional team members? *

- (●) YES
- ( ) NO

ADDITIONAL TEAM MEMBER

30

Team Member's Full Name *

James Kim

31

Team Member's Department/Campus Affiliation *

School of Molecular & Cellular Biology

32

Team Member's University Email Address *

hkim496@illinois.edu

33

Do you have additional team members? *

- ( ) YES
- (●) NO

SUPPORTING DOCUMENTATION

34

OPTIONAL: Attach any letters of commitment or support here along with any supplemental media that will support your application (presentations, photos, etc.).

Project proposal-Quanhui Ye_Quanhui Ye.pptx

PROJECT FINANCES

35

Describe in detail how SSC funds will be used in your project.

NOTE: Only address the use of SSC funds, specifically, even if the project will be funded by multiple sources.

We will use the SSC funds to purchase the materials listed in the budget form, ensuring they are necessary for completing the project. We will minimize reagent usage and recycle lab materails to maximize efficiency and reduce waste.

36

If you receive SSC funding, will your project require additional sources of funding to achieve your project's overall goals? *

NOTE: SSC cannot guarantee financial support beyond that provided in an approved funding agreement.

- ○ YES
- ◉ NO

37

Has your project team or department previously been awarded funding from the SSC for the same or a similar project? *

- ○ YES
- ◉ NO

38

Download, complete, and submit the **SSC-Budget-Timeline_NEW APPLICATION_template** file linked below. Please be very detailed so that the SSC can fully evaluate the merits of your funding request. **We STRONGLY recommend providing alternate budgets in addition to your main budget in case SSC cannot fully fund your project. There are alternate budget tabs in the template.**

https://studentengagement.illinois.edu/sites/default/files/2024-09/SSC-Budget-Timeline-NEW-APPLICATION-template.xlsx *

SSC-Budget-Timeline-NEW-APPLICATION-step 2_Quanhui Ye.xlsx