

# Ideas For In-Class Capstone Projects

## Microbial Bioremediation

Investigating the ability of different types of microorganisms to degrade pollutants in simulated environmental samples, such as soil or water contaminated with oil or heavy metals.

## DNA Extraction and Analysis

Extracting DNA from various sources, such as fruit, vegetables, or saliva, and performing simple genetic analyses such as PCR amplification or gel electrophoresis to visualize DNA bands.

## Bacterial Transformation with GFP

Introducing a plasmid containing the green fluorescent protein (GFP) gene into bacteria using a transformation protocol and observing the transformed bacteria under a fluorescence microscope.

## Plant Tissue Culture

Culturing plant tissues on nutrient media to propagate plants from tissue explants or to induce somatic embryogenesis, and learning techniques for sterilization, subculturing, and plant regeneration.

## Microscopy and Cell Biology

Observing and comparing different types of cells (e.g., plant cells, animal cells, bacterial cells) under a light microscope or a digital microscope and learning basic cell staining techniques.

## Antibiotic Sensitivity Testing

Testing the sensitivity of bacteria isolated from environmental samples or from students' hands to different antibiotics using disk diffusion or broth dilution methods.

## Biotechnology in Agriculture

Investigating the use of genetically modified crops or biofertilizers for improving agricultural productivity or sustainability and discussing the potential benefits and concerns.

## Bioinformatics Analysis of DNA Sequences

Analyzing DNA sequences obtained from PCR or sequencing experiments using bioinformatics tools such as BLAST and interpreting the results to identify genetic similarities or differences.

## Food Microbiology and Safety

Assessing the microbial quality and safety of food products by performing microbiological tests such as total plate count, coliform count, or yeast and mold count.

## Biomedical Engineering Design Challenge

Designing and prototyping a simple medical device or diagnostic tool, such as a low-cost microscope, a urine test strip reader, or a prosthetic limb prototype.

## Environmental Monitoring with Bioindicators

Using living organisms (e.g., aquatic macroinvertebrates, lichens) as bioindicators to assess the ecological health of local ecosystems, such as rivers, lakes, or forests.

## Gene Expression Analysis

Extracting RNA from cells or tissues and performing reverse transcription followed by PCR to analyze gene expression levels of specific target genes under different experimental conditions.

## Biotechnology and Art Integration

Integrating biotechnology concepts with art by creating microbial art (e.g., agar art), bioluminescent sculptures, or bio-inspired artworks using natural materials.

## PLACES TO INQUIRE ABOUT INTERNSHIPS OR MENTORSHIPS IN BIOTECHNOLOGY OR THE BIOMEDICAL INDUSTRY

[Youth STEM Connection](#)

[High School Student Opportunities](#)

[Stanford Medical Youth Science Program](#)

[Biorocket—Genspace](#)

[Research Science Institute | Center for Excellence in Education](#)

[Lumiere Research Scholar Program](#)

[CDC Museum Disease Detective Camp: Frequently Asked Questions](#)

[Summer Programs: Education & Training](#)

[Explore Summer Medical Programs for High School Students](#)

[High School Internship—Max Planck Florida Institute for Neuroscience](#)

[High School | Project Success | DICP](#)

[The Rockefeller University » Summer Science Research Experience—RockEDU Science Outreach](#)