

Capstone at Virginia Tech: Putting It All Together

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“Do what you love. Create a better world.” That’s the challenge we present to students who enter Virginia Tech’s Biological Systems Engineering (BSE) program as sophomores. Over the next three years, BSE students explore their interests and hone their engineering skills, culminating in the senior capstone course.

Each year, a new set of projects is nominated by BSE faculty, graduates, and other contributors. The descriptions of these projects are very broad to encourage creativity, and the students select from a wide range of topics. For example, the fall 2021 choices included creating high-protein nutrition bars, isolating protein from microalgae residue, and developing design plans for a stream restoration project.

In 2022, nine student teams solved practical problems. Based on the results of the end-of-semester poster competition, the following three teams ranked highest in creativity, clarity, organization, approach, process, and results.

Hellbender Project in Tom’s Creek

The eastern hellbender, a giant salamander, is an important indicator of stream ecosystem health in the eastern U.S. and has recently been identified in the Tom’s Creek watershed in Virginia. A section of Tom’s Creek is experiencing bank erosion, over-widened channels, and riparian buffer loss, all of which decrease the hellbender habitat. This team redesigned two stream crossings in the affected area to limit bank erosion and downstream sedimentation and included hellbender habitat structures.



Team members for the Hellbender Project in Tom’s Creek (left to right) Nathaniel Abrahams, ASABE members Rachel Lake and Sarah Loomis, and Jacob Bellinger (team member Diana Schmidt not shown).



Culpeper County BMP and Stormwater Infrastructure team members (left to right) ASABE members Amara Shareef and Kelly Ruffner, and Chloe Wynns.

Culpeper County BMP and Stormwater Infrastructure

Due to population growth, waterways in Culpeper County, Virginia, have suffered water quality impairments and created concerns about local flooding. Flooding can affect public welfare, and it can be managed through infrastructure. This team worked with Friends of the Rappahannock, a local environmental organization, to develop viable and cost-effective green infrastructure and best management practices (BMPs) to support the region’s watershed implementation plan.

MOPP System for Heart Transplantation

Heart disease is one of the leading causes of death in the U.S., and heart transplantation is sometimes the best treatment option. Preservation of the donor organ is critical, but a limitation of current preservation techniques is their inability to retain organ viability, which can result in tissue damage. This student team designed a Machine Organ Perfusion Preservation (MOPP) system for heart transplantation that sustains the donor organ during transport and delivery.

At Virginia Tech, the BSE capstone course requires a commitment. It is resource-intensive, high levels of instructor coordination and oversight are required, and no two years are the same. However, the commitment is more than repaid by the benefits—not just for the students, but also for the mentoring teams and instructors.

As long-time BSE capstone instructor Cully Hession said: “Watching students apply what they’ve learned in the classroom to what they’re passionate about is why I love teaching this course.”

Cameron Warren, Communications Specialist, ASABE member Cully Hession, P.E., Professor and Graduate Program Director, and ASABE member Dwayne Edwards, P.E., Professor and Head, Department of Biological Systems Engineering, Virginia Tech, Blacksburg, USA, dredwards@vt.edu.



The Machine Organ Perfusion Preservation (MOPP) system developed by BSE students at Virginia Tech.

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—Alicia Ziegler, BAE alumna



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