

Biological Engineering Students Showcase Innovation at Senior Design Night

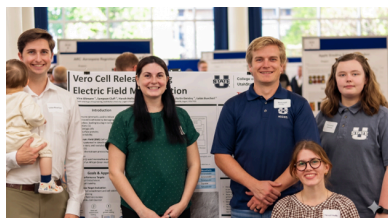
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Senior Design Night brought together projects from across the College of Engineering, highlighting the work of graduating students as they apply their knowledge to real-world challenges. Among them, Biological Engineering senior capstone design teams applied engineering principles through design, testing, and experimental investigation across projects spanning biomedical systems, sustainable technologies, and advanced process design—reflecting the interdisciplinary nature of the field. And between then we had:

Non-Enzymatic Detachment of Adherent Cells Using Electromagnetic Fields

The team formed by students Sampson Cluff, Kade Robinson, Emilia Huff, Hannah Hollis, and Christine Altman focused on alternative methods for detaching adherent cells from surfaces without relying on enzymatic treatments. In standard practice, cells are detached using trypsin, an enzyme that breaks the bonds holding them to a surface. While effective, this process introduces complications, as any remaining traces must be carefully removed to avoid interfering with downstream applications or causing cellular damage.

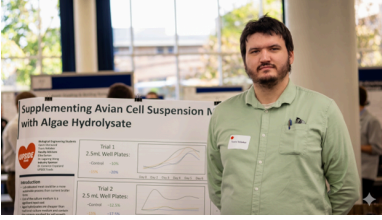
The team investigated whether electromagnetic waves could provide a non-chemical alternative. Their approach involved passing controlled electrical signals through a cell passaging system, supported by a custom-built setup capable of delivering varying levels of voltage and frequency. Guided by literature suggesting both low-voltage/high-frequency and high-voltage/low-frequency conditions, the team explored multiple configurations. Although no successful detachment was achieved, the results highlighted key limitations in signal generation and transmission, providing direction for future refinement of the system.



Cost Reduction of Cultured Chicken Media Using Hydrolyzed Algae Supplementation

The team formed by students Travis Decker and Gavin Sherwin addressed one of the primary challenges in cultivated meat production: cost. Lab-grown chicken remains significantly more expensive than traditional broiler chicken, largely due to the high cost of the culture medium used for cell growth.

To reduce this cost, the team explored the use of hydrolyzed algae as a partial replacement for the culture medium. By breaking down algae, its sugars and growth factors become available as a nutrient source. The team conducted multiple trials, replacing 10%, 15%, and 20% of the base media and tracking cell density over time. Results were inconsistent across experiments, making it difficult to determine an optimal ratio. However, their findings suggest that approximately 17.5% replacement may be feasible, offering a potential pathway toward lowering production costs. Future work will focus on scaling the process within a bioreactor system.



Osseointegrated Intramedullary Stem Design for Improved Lower-Limb Prosthetic Stability

The team, formed by students Isabel Anderson, Cassandra Butler, Colin Major, Hayden Rouse, and Sam Young, focused on improving lower-limb prosthetic integration and reducing recovery time. The team examined both socket-based prosthetics, which often cause discomfort and skin irritation, and osseointegration, a method in which a metal implant is inserted into the femur and fuses with the bone.

While osseointegration offers improved mobility and more natural sensory feedback, it typically requires a recovery period of up to one year. To address this, the team collaborated with OsteoCentric to implement a specialized thread design that enables immediate mechanical integration with the bone. This design provides early-stage stability that approaches the strength of a fully healed implant, with the potential to significantly reduce recovery time and improve patient outcomes. The team was advised by Justin Hyer and Spencer Bunn of OsteoCentric and Dr. Keith Roper of Utah State University.



Development and Validation of a Robotic Laparoscope with Virtual Reality Control Interface

The team formed by students Emma Gatherum, Logan Pond, Kaleb Buchmiller, Orion Chase, and Kurtis Bryson, developed a robotic laparoscope system with integrated virtual reality controls. The project focused on creating a system that could function effectively within an operating room while improving precision and usability through advanced control methods.

The team achieved a fully operational robotic scope capable of articulation and directional control. Building on this, they integrated a virtual reality interface that allows the operator to control the scope through head movement, enabling hands-free interaction. This approach enhances spatial awareness and opens the possibility for multi-operator collaboration, where one individual manages visualization while another performs the procedure.

A major consideration throughout the project was clinical usability. The team addressed challenges related to orientation, user comfort, and minimizing motion-related disorientation, ensuring the system aligns with the expectations of medical professionals. While further refinement is needed, the project demonstrates strong potential for combining robotics and immersive technology in surgical environments.



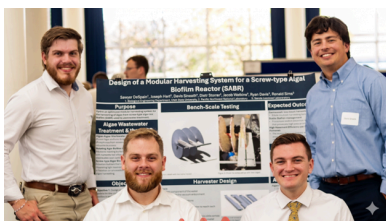
Design of a Modular Harvesting System for a Screw-Type Algal Biofilm Reactor

The team formed by students Sawyer DeSpain, Joseph Hart, Davis Sineath, and Dietr Storrer focused on the design of a modular harvesting system for a screw-type algal biofilm reactor (SABR). This system serves as an alternative to traditional rotating algal biofilm reactors (RABR), which often experience uneven light distribution due to shelf-based designs.

By improving light penetration and increasing surface area within the same footprint, the SABR system promotes more consistent algae growth. Increased biomass production enhances water treatment efficiency while creating opportunities for downstream applications such as biofuels, fertilizers, and bioplastics.

A key focus of the project was optimizing the harvesting process. The team developed a modular system with interchangeable blade types, such as squeegees or razors, depending on the application. A spring-loaded mechanism maintains consistent cutting depth to prevent over-harvesting and preserve biofilm health. Future iterations may incorporate magnetic systems for improved precision.

The design also includes a vacuum-assisted collection system, enabling automated harvesting without manual intervention. This allows for scheduled operation and improved sample preservation, increasing efficiency compared to traditional methods. Future teams are expected to build on this foundation by implementing full automation.



Biohydrogen Production from Fruit Processing Waste via Microbial Electrolysis Cells

The team formed by students Casabelle Henderson, Cassandra Baller, Colin Major, Hannah Rouse, James Smart, Dieter Stroer, and Seth focused on converting fruit processing waste into biohydrogen using microbial electrolysis. Fruit processing generates large volumes of organic waste that must be treated to prevent environmental impact, often at significant cost.

The team developed a reactor system using *Geobacter* bacteria, which can break down organic material and produce hydrogen gas when voltage is applied. Initial testing used synthetic wastewater to control experimental variables, with multiple iterations leading to stable and reproducible data. The team identified current density as a key indicator of system performance, as it correlates directly with hydrogen production.

As the system matured, the formation of a stable biofilm allowed the team to transition into optimization. Using chemical oxygen demand (COD) analysis, they determined appropriate feeding levels to maintain system balance without

overloading the bacteria. Their results suggest that fruit waste can be effectively integrated into the process, with future work focused on replacing synthetic media entirely and increasing processing capacity.

Together, these projects highlight the breadth of Biological Engineering at Utah State University, where students apply engineering principles to complex biological systems. From medical innovation to sustainable resource management, Senior Design Night reflects both the challenges and opportunities that define the field—and the impact these students are prepared to make beyond graduation.

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