Support. Improve. Save.

Michigan Technological University
1885

COLLEGE OF ENGINEERING
ENGINEERING BETTER HEALTH
INITIATIVES

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Hands in. Join us.

Advance the Future of Healthcare

Pictured: The newest building on campus at Michigan Tech.

Improving Healthcare

OVERCOMING OBSTACLES

We seek to improve human health and healthcare at all levels.

Tissue engineering and biomaterials. Biosensors and instrumentation. Biomedical optics and ultrasound. Cardiovascular engineering. Medical microdevices. Vaccine development. Cancer detection. From diagnosis and analysis to treatment and recovery, we are dedicated to improving lives.

Our new H-STEM building supports integrated education, health, and human-centered technological innovations.

Bringing together multidisciplinary teams in a collaborative and flexible lab space promotes the development of game-changing innovation and heightened student learning. We also seek to increase partnerships and collaboration with medical professionals across the country.

We need support to enable increased collaboration, and to instrument the building, deploy robotic systems, collect data, and visualize solutions.

Engineering an End to Cancer

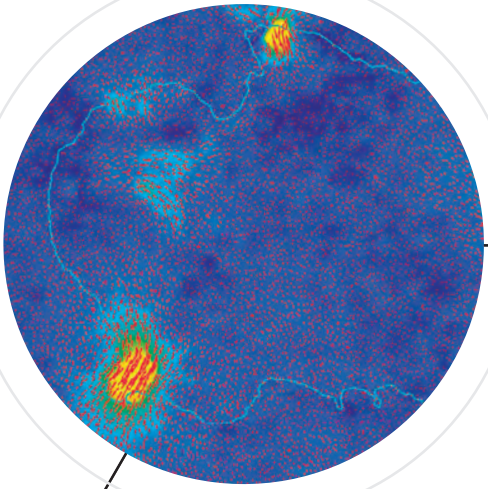
DETECTING DISEASE

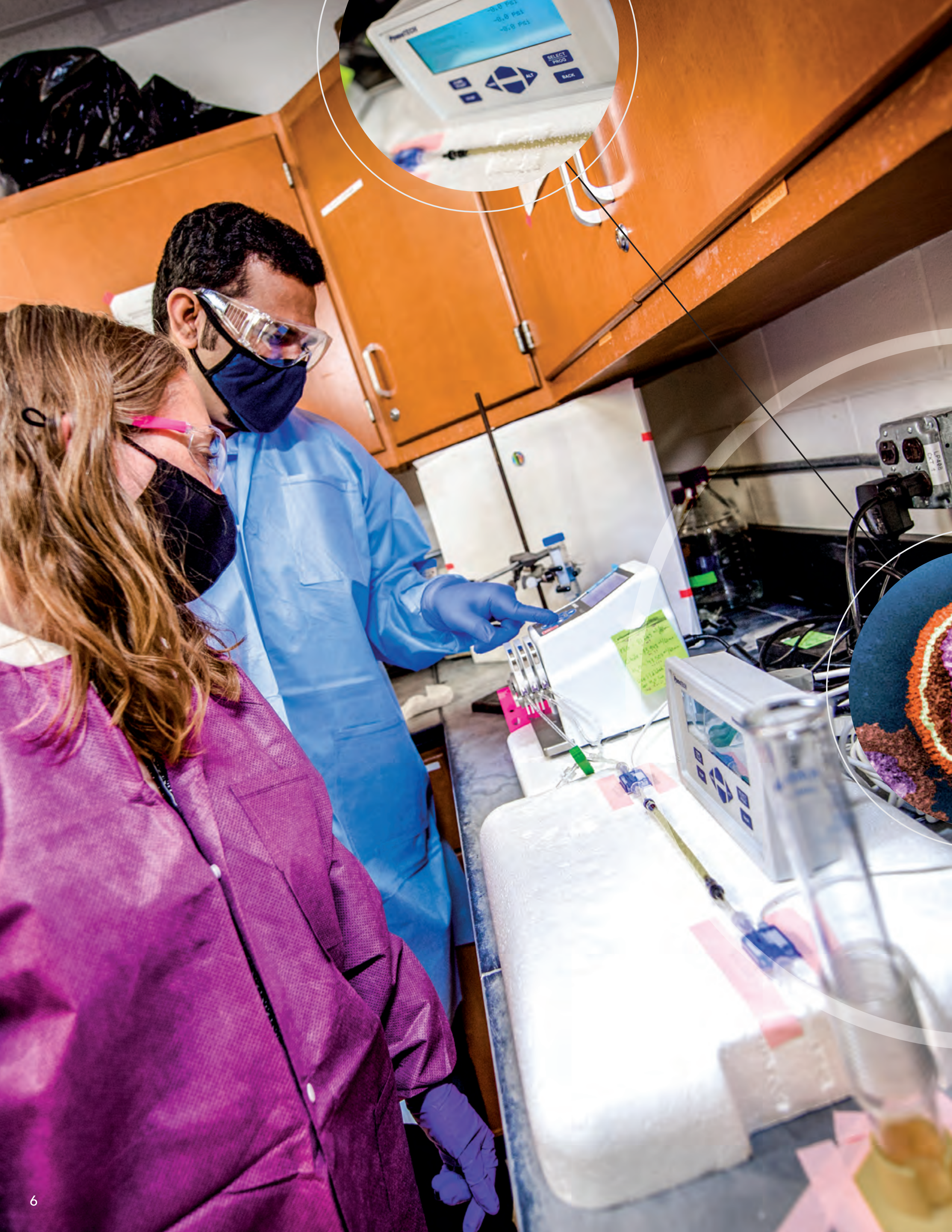
We track the spread of cancer with biomechanical modeling, which is used to measure the forces between cells, as well as the force cells require to migrate and move.

We need high resolution scanners, microscopes, and imaging to analyze disease at the cellular level. With access to a micro-CT scanner, two-photon excitation microscopy, a confocal microscope, thunder imager, and other tools, we can accurately image, detect, and work toward a cure.

Micro and nanotechnology allow us to uncover and study the hardness, stiffness, and movement of cells. We seek to differentiate benign cells from malignant ones in a promising new way, at a very early stage, using tools we develop to measure the mechanical properties of tissue.

Using ultrasound and laser light imaging, we also visualize blood flow and perfusion in tissues and the brain. Advanced artificial intelligence comes into play to sense differences, create genetic profiles, and collect precise information without extensive use of resources.




SELECT
PROG
BACK
ALT

Engineering Virus Purification

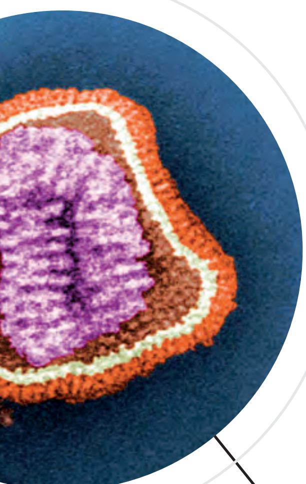
PHARMACEUTICAL FUTURE

The creation of a new influenza vaccine begins taking shape eight to 10 months before flu season.

With the use of a bioreactor, the process can shift from batch to a continuous end-to-end process—adding cells until there is a purified vaccine. The result would allow flu strains to be pivoted within two months and would enable for a reduced manufacturing footprint.

We explore viruses on the particle level to separate the cell from the contaminants, which can be applied to things like vaccine stability for broader distribution. This can lead to increased ability to more broadly distribute vaccines.

To innovate in the pharmaceutical environment, we must increase our focus on bioprocessing. We need support for undergraduate and graduate student laboratories. We need bioreactors and mammalian cell culture facilities with air control hoods. We also need a dedicated animal care facility.



Engineering Medical Devices

CONTROLLED COLLABORATION

> Nature—and multidisciplinary teamwork—inspire many new ways to advance biomedical engineering.

We design microfabrication techniques to protect cartilage cells from stress, allowing cells to regain, maintain, or regenerate their cellular properties after an injury.

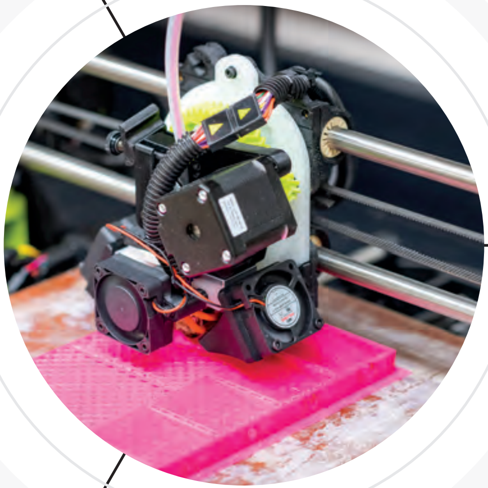
We create smart surgical adhesives by exploiting the ability of a Dopa found in the natural glues made by mussels that anchor them to rocks, boats, and docks.

We analyze neural pathways using light as a control mechanism to explore neural control of prosthetics.

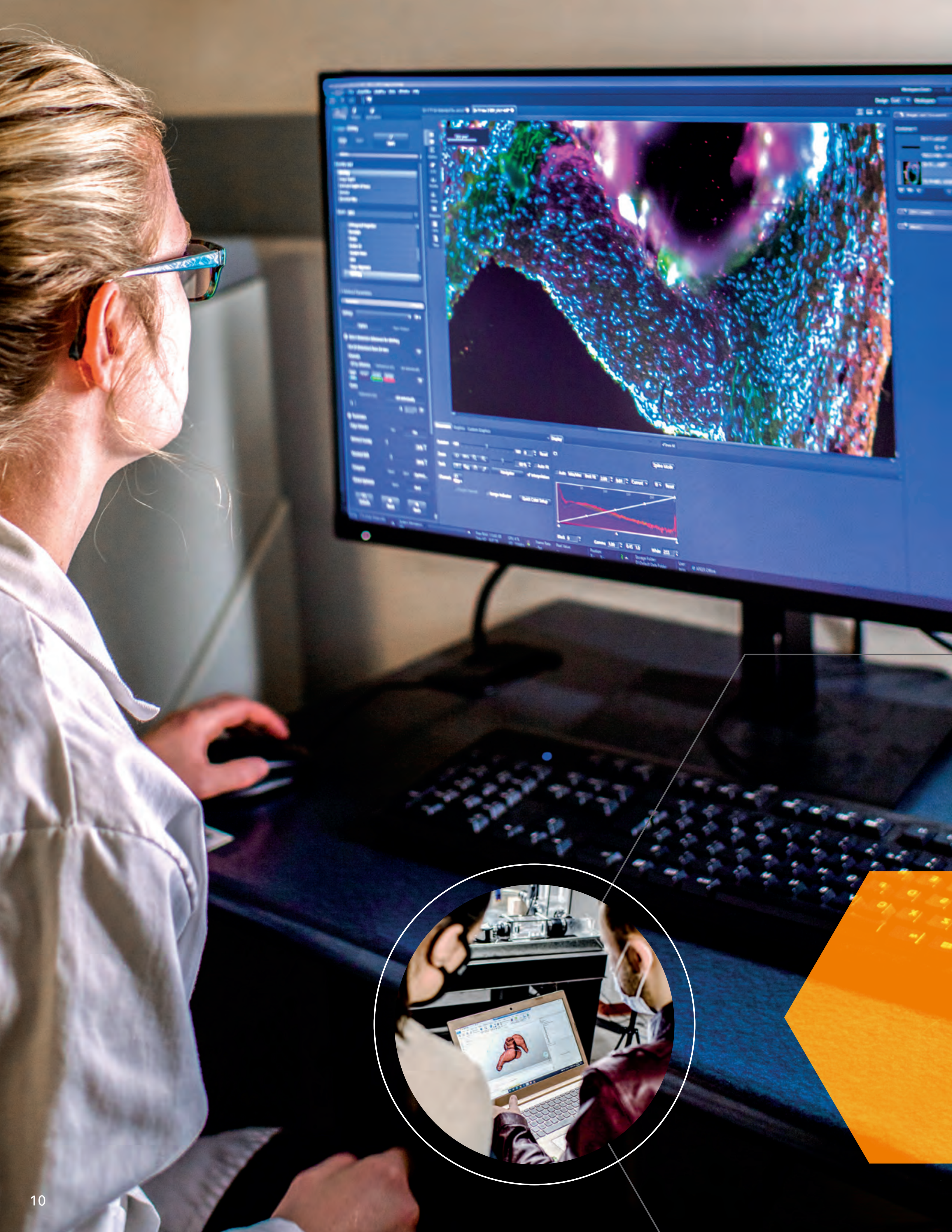
We engineer nanotextured orthopedic implants with antibacterial properties to reduce the risk of postoperative infection.

We develop algorithms and tools for patient-specific, precision medical interventions and diagnostics—using computer-aided technologies that combine imaging, physiologic, and behavioral information into a unique treatment plan tailored to individuals.

We employ computational biomedical engineering to improve low-cost health care delivery for low resource areas such as the rural Upper Peninsula of Michigan.



Analyzing data comes with high computational requirements. We need a small, high-performance cluster with GPU support dedicated to computational bioengineering. We also need a confocal microscope with controlled laser localization, and special photoactivated, localized microscopy.



Engineering at Heart

MAKING CARDIOVASCULAR PROGRESS

Advancements at Michigan Tech range from tissue engineering to imaging.

Modeling tracks blood flow through the heart for the development and assessment of new heart valves. With particle image velocimetry methods, we analyze leakage and overall valve performance. We integrate artificial intelligence into our simulation workflow to inform models accurately.

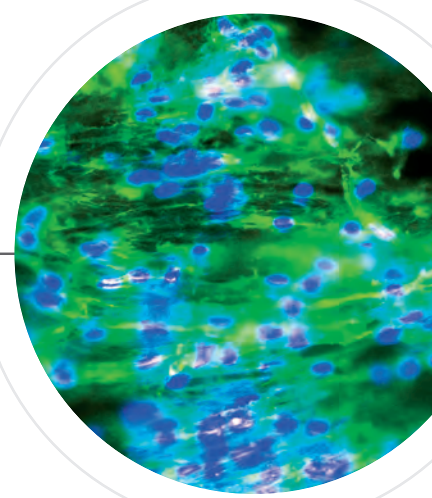
Another goal is improved tissue modeling. With a focus on cardiomyocyte maturation, cardiovascular tissue engineering advancements at the nanoscale allow the creation of heart patches used to restore heart rhythm after a damaging heart attack or stroke.

We grow scaffolded tissue that can beat on its own for a period without stimulation. The process can further be applied to drug delivery, transitioning from human and animal testing to tissue cell testing to visualize the mechanical and electrical stress and morphology.

We measure the chemical and mechanical fluid flow signals that cause cells to differentiate into the correct format for a specific organ or tissue, using adult stem cells. One possible application of this new knowledge: arteries grown ahead of time for surgeons, who could select a living artery made specifically for a heart bypass, rather than using a vein from the patient's leg or groin.

We also develop new dissolving metallic stents—testing their strength and biocompatibility, and ensuring they prevent collapse or reclogging of arteries.

We need advanced scanners and microscopes to accurately analyze samples. When looking at the micro and nano patterned scaffolds, a nanoimprint lithography system would be impactful in understanding the matrix interactions and stem differentiation.



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