

Scientists can sequence a person's entire genome for \$1,000.

Doctors can laser a kidney stone to extinction, navigating a patient's body with live footage from microscopic cameras without a single incision.

Researchers can take a cell from a patient's body, grow it in a dish, reprogram it to attack a tumor and transplant it back into the patient.

No, this isn't science fiction. It's biomedicine. And it is changing the world.

A relatively new field, biomedicine—a term first introduced in the 1930s, preceded by "biomedical" a decade earlier—incorporates the aspects of medicine derived from the natural sciences, particularly biology, biochemistry and biophysics.

Florida Tech offers undergraduate degrees in both biomedical science and biomedical engineering, as well as a master's degree in biotechnology.

What's the difference?

Where biomedical scientists are more interested in basic research discoveries and developing therapeutics—understanding, diagnosing and treating disease—biomedical engineers typically focus on practical solutions—creating new technologies with medical applications.

Essentially, biomedical science evaluates "What?" "How?" and "Why?" while biomedical engineering and biotechnology aim to answer, "How can we fix it?"

While becoming a doctor is a popular career path for biomed students, it is one of many intertwining options within the greater scope of health care.

Researchers make initial discoveries. Biotech companies translate those discoveries into therapies. Pharmaceutical companies formulate the next groundbreaking medications. Engineers design and create tangible medical tools and prosthetics. And physicians apply it all to benefit their patients.

Aside from science and engineering careers, a biomedical mindset has benefits in fields such as patent law (Who made the most critical discovery first?), business (What are the most promising advances to invest in?) and education and outreach (How do we close the disconnect between the basic sciences and the public's appreciation of science?).

"Career paths in biomed really span the gamut," says Eric Guisbert, an associate professor in Florida Tech's biomedical and chemical engineering and sciences department, "and our alumni do it all."

Nationwide, biomed is rapidly growing, with employment of biomedical engineers and scientists expected to grow by 10% and 17%, respectively, from 2021 to 2031—significantly faster than the average for all occupations, according to the U.S. Bureau of Labor Statistics.

Why?

Some attribute the increase to a demand for physicians—as the population ages, more people need more doctors.

Some recognize that as technology advances, so must its applications in all fields, including health care.

If you ask Guisbert, a biomedical scientist, it's the desire to change people's lives for the better that draws people to biomed.

"This is such an impactful part of everyone's lives," he says. "We want to do everything possible to help patients—those with Alzheimer's, cancer and other diseases. It's very rewarding because we're doing something important. We're trying to help humanity."

The biomed boom is just beginning, and with proper nurture and collaboration, the Space Coast is poised to become a hub of biomedical innovation and advancement. Florida Tech is leading the charge.

On campus, we have students conducting advanced biomedical research in areas such as regenerative medicine, tissue engineering, nanotechnology and more.

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Administration is investing in cutting-edge resources and facilities, like the new Gordon L. Nelson Health Sciences building, which features 20,000 square feet of classrooms and labs, augmented and virtual reality teaching tools and more, and is expected to double the size of the biomedical engineering program and drastically increase the size of the undergraduate premedical program.

As Florida's STEM university and home to the world-class Nathan M. Bisk College of Business, we are cultivating the next generation of both STEM-minded businesspeople and business-minded scientists and engineers to develop and market the next "big thing" in biomed.

With the know-how to attract investors to fund said "big thing," are university-affiliated entrepreneurial organizations, such as weVENTURE Women's Business Center. And with the resources to build and cultivate it, is the Center for Advanced Manufacturing and Innovative Design (CAMID), Florida Tech's innovation accelerator that connects businesses of any size with advanced manufacturing resources and faculty expertise.

Factors such as these, paired with the university's location in the heart of Florida's high-tech corridor, have laid the groundwork for Florida Tech's most recent step toward biomedical renown: an affiliation agreement with Burrell College of Osteopathic Medicine (details on page 26).

In its first year, the affiliation, announced in January, will bring 100 first-class medical students to campus, where they'll receive a top-notch education from an established, reputable medical school fortified by access to Florida Tech's state-of-the-art tools and facilities.

In a rapidly evolving industry with so many diverse yet connected facets, collaborations such as these present the opportunity to share not just equipment, but ultimately, ideas, vision, perspective.

Seeking some of this perspective, we spoke to a few Florida Tech alumni—now and forever, our most valuable contribution to the biomed industry—about the most impactful ways biomed is shaping health care, society and the future. »



Theodore Schuck

DEGREE: '16 MBA, Health Care Management

OCCUPATION: Family Medicine Doctor and Chief Medical Officer, Brevard Health Alliance

"It's important that we continue to grow from a technology standpoint. Like any other field, if we're not making innovations and changes, then we're not progressing."

Putting medicine in the patient's hands.

Wearable EKG and continuous glucose monitors, biosensors, smartwatches and fitness trackers enable you to check real-time health stats like heart rate, blood pressure, blood sugar and oxygen levels, sleep health and more with a quick glance at your cellphone—quite literally, putting your health in your own hands. "Thanks to these new technologies, we're seeing

individuals' health care being placed more so on the patients themselves, and physicians being the guide, but not necessarily the treater," says **THEODORE SCHUCK** '16 MBA, a family medicine doctor and chief medical officer at Brevard Health Alliance. "You're going to be your own best advocate for health care."

Since he graduated from medical school over 10 years ago, Schuck, who earned his MBA in health care management from Florida Tech, has seen patientguided treatment make its way to the forefront of health care. This, he says, is in response to both technological advancements and a general shift from acute care to more chronic disease management.

"People are living longer. So, they have to be able to manage some of these disease states that, unfortunately, we can't cure, such as diabetes or heart disease," he says. "So, it's a matter of them being able to determine what they can do for their own health to feel better—whether it's taking their medicines, exercising or just knowing their status, and then reporting those results to their primary care doctor."

Improving patient outcomes.

"How can we use our current resources to improve people's lives?"

That is the question **PAMELA FORERO** '17 continually strives to answer in her work as a process development engineer at Humacyte, a regenerative medicine company in Research Triangle Park in Durham, North Carolina.

Humacyte creates artificial blood vessels using human cells that scientists develop into tissue and implant into the body to restore blood flow.

Other options exist: an artificial blood vessel made from a synthetic graft or blood vessels extracted from a cadaver or another part of your body. But these either require additional surgeryposing additional risk-or have high infection ratesbecause the body rejects the unrecognized materials.

"We've worked with so many doctors who have told us, 'Your product is going to change everything. It is saving lives,'" Forero says. "That is why I chose this career."

Her work, Forero says, is never done. She and her team are continuously experimenting with ways



Pamela Forero

DEGREE: '17 B.S., Biomedical Engineering

OCCUPATION: Process Development Engineer, Humacyte

"Biomedical engineering, despite its many years, is still a new field, and I don't think we even know all of the things we are capable of because it just keeps growing and growing."

to improve the process, working with scientists and engineers in several biomedical subfields with varying expertise.

"Take all the physics, all the chemistries, all the biologies, all the engineerings and apply those to the body—that's what we do," she says. "That's the really cool thing about biomedical engineering. Everything is connected, and through collaboration, you can achieve something really, really mind-blowing."

Personalizing medicine.

Before ever administering a therapeutic, scientists can know almost exactly how the treatment will affect your body—not a similar body. Not most bodies. Your body.

ISIAH MOSSIAH '20, '21 M.S., is a research associate at Hesperos Inc., an Orlando company that uses human-on-a-chip® technology to conduct disease modeling and drug testing. According to Hesperos, human-on-a-chip is an "interconnected, reconfigurable, multi-organ in vitro platform reproducing the functional aspects of human physiology, providing unprecedented visibility into how the human body will respond to chemicals and novel therapeutics."

One application of the human-on-a-chip system involves differentiating a patient's cells that are affected by disease and placing them in a microfluidic chip in conjunction with other relevant organ types. Then, researchers, like Mossiah, test whether different treatments can restore function when compared to healthy cells, ultimately, allowing the patient and his or her doctor to administer the most safe and effective medications.

"Personalized medicine is essential to improving the quality of care people get, especially those with rare diseases," Mossiah says. "Instead of giving patients something that could potentially help them, we can give them something that we know could help them because we tested it prior."

While other labs conduct similar research, Hesperos is one of few that have commercialized the technology, transitioning it from academia to industry.

"Ever since we decoded the human genome—and that was a huge, huge discovery—now it's just trying to figure out what genes do what in the body and using that information to develop therapies that can actually help people," Mossiah says.

Isiah Mossiah

DEGREE: '20 B.S., Genomics and Molecular Genetics B.S.; '21 M.S., Biotechnology

OCCUPATION: Research Associate, Hesperos Inc.

"The future of biotech is having people and companies that are multidisciplinary, allowing them to maximize the biological applications they're trying to study."

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Biomed Boost: Florida Tech and Burrell College of Osteopathic Medicine Announce Plans for Medical School Affiliation Agreement Paves Way for Proposed

2024 Opening on Melbourne Campus



The Burrell College of Osteopathic Medicine (BCOM) and Florida Institute of Technology have entered into an affiliation agreement to establish a four-year osteopathic medical school on Florida Tech's Melbourne campus.

"We are excited about our proposed new campus in affiliation with Florida Tech. Over the past three years, we have operated a regional academic center in Brevard County for our medical students' clinical clerkship rotations; 34 of our third- and fourth-year students are currently conducting these rotations," says John L. Hummer, co-founder and president of BCOM. "Based upon the success of this regional academic center and the positive relationships established with key stakeholders, the natural next step was to develop an additional four-year medical school location in Florida."

The need for physicians is growing rapidly in the Sunshine State.

Florida will be short approximately 18,000 physicians by 2035, according to a 2021 study from The Safety Net Hospital Alliance of Florida and the Florida Hospital Association. The Association of American Medical Colleges (AAMC) reported that only 32% of Florida's population has adequate primary care and that nearly half of primary care physicians are expected to retire in the next 15 to 20 years.

Additionally, in 2021 research into the medical workforce, AAMC found that 47.4% of Florida-based medical school graduates practiced medicine in Florida, and 78.8% of physicians



who completed both medical school and residency in Florida remained in the state to practice.

"We desperately need the next generation of highly trained physicians around Florida and across our nation," says Florida Tech Interim President Robert King. "This affiliation with the Burrell College of Osteopathic Medicine allows Florida Tech and its students to be part of the solution to one of the biggest challenges facing our society today: ensuring adequate access to high-quality medical professionals. We are excited about the prospects."

BCOM executed the affiliation documents to open the additional location with Florida Tech in November 2022 contingent upon final approval from the college's accrediting body. The inaugural class will include 100 students and is expected to matriculate in July 2024 and to graduate in May 2028.

"We are grateful for Florida Tech's invitation to establish a mutually beneficial affiliation agreement, which is based upon a shared mission of addressing the significant physician shortage, especially in underserved areas," says Dr. Bill Pieratt, dean of BCOM.

The medical school will be in Florida Tech's L3Harris Commons via a sublease agreement. Burrell students will be able to use Florida Tech's libraries, fitness facilities, student health services and housing. The agreement also allows for collaborative research and teaching opportunities between both institutions. A vital component of the affiliation agreement is the Medical School Pathway program, whereby Florida Tech premed students will be guaranteed admission into Burrell if they meet the established criteria for academic performance.

Marco Carvalho, Florida Tech's executive vice president, provost and chief operating officer, says that with their success in shaping the brightest young minds with hands-on instruction and cutting-edge technology, BCOM and Florida Tech are a logical and powerful fit.

"We are pleased to welcome Burrell to our campus and look forward to the academic and research connections we will most certainly forge," Carvalho says.

To date, Burrell's campus in New Mexico has graduated 430 osteopathic physicians. Of its graduates, 99.5% have been successfully placed into medical and surgical residency training programs. Currently, Florida ranks third in the country among the states where Burrell's applicants reside.

Osteopathic medicine is one of the fastest-growing health care professions. According to the Osteopathic Medical Profession Report, the number of osteopathic physicians in the U.S. climbed to nearly 135,000 in 2021. Today, one in four medical students in the U.S. is training to be osteopathic physicians.

Enhancing the learning experience.

In her first year of medical school, **AMANDA KAHN** '18 was able to "run a code": administer immediate resuscitative measures, like performing CPR and applying an AED, on a patient in sudden cardiopulmonary arrest.

Thankfully, she says, the patient was a simulation mannequin.

"It can be very overwhelming," Kahn says. "So, to have the experience with a simulator in a safe educational space, where no one's going to get hurt, and you can practice and mess up and it's no big deal, is amazing."

A fourth-year medical student at Florida International University in Miami, Kahn still remembers the lessons she learned on the simulator—a life-like human body with a heartbeat, a pulse and the ability to move its eyes, blink and have a seizure—and applies them in the hospital today.

In addition to simulators, advances in camera and robotic technology have really made it easier for students to study anatomy, she says.

The da Vinci surgical system, for example, is a robot that docks on

top of a patient lying on an operating table. Its high-definition camera allows physicians-in-training to see everything the surgeon does from the surgeon's viewpoint.

"As a med student, you're the last person in line to have the best view in an open surgery," Kahn says. "But now, I can sit in the corner of the operating room, not have to be scrubbed in or touching the patient, and I can see everything very clearly. It has really changed things for learners."

Kahn is applying to the field of urology, a surgical field, and is interested in urologic oncology, minimally invasive surgery with robotics and endoscopic urology. She has seen firsthand how biomedical advances, like laser technology in noninvasive surgery, have improved the patient experience, as well.

"In urology, you really get to mix biotechnology, patient care and medicine, so I think it's part of why I'm super interested in the field," she says. "There's always new technology coming out, always trying to get better, trying to improve."

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Amanda Kahn

DEGREE: '18 B.S., Biological Sciences, Premed

OCCUPATION: Medical Student, Florida International University

"When I think of my community, I think of our patients-the people we're here doing all of this for. I think the biomed industry has driven a lot of patient care improvements in the last 20 years, and I think it's going to continue."

