The Big Idea

Q. How do you help people with painful knees get going again?

A. By teaching their cells to regenerate cartilage.

By April Wilkerson

Millions of people suffer from knee pain, often because their cartilage has become worn or injured. Before they reach the point of needing painkillers every day or undergoing knee replacement surgery, what if there were a way to prompt their bodies to grow new cartilage and allow them, quite literally, to stay on their feet?

Because of research conducted by a graduating senior at the University of Oklahoma, that possibility isn't too far from reality. Emily Thomas, who will earn a bachelor of science degree in biomedical engineering this spring, leaves a legacy that few undergraduates do.

Through ongoing laboratory studies, she hopes to stimulate cartilage regeneration using a novel biomaterial. The long-term goal would be using this discovery as a therapeutic that allows patients with cartilage defects to return to normal, weight-bearing activities right away, preventing a lifetime of arthritis pain or surgery.

"I love the idea of being able to mimic the body's natural environment in the lab to direct cells to behave in a way that might have therapeutic effects," Thomas says. "This has been an amazing experience."

Thomas, who is from Chickasha, Okla., became involved in research as a freshman at OU through the FYRE (First-Year Research Experience) program. She quickly connected with other students in the laboratory of Michael Detamore, founding director of the Stephenson School of Biomedical Engineering in OU's Gallogly College of Engineering.

Detamore and some of his students had conducted previous research on cartilage regeneration, but Thomas took it to a new level. For her experiments, she took cartilage from the knees of pigs, ground it up and chemically modified it, resulting in a paste-like material. An orthopedic surgeon could then inject the paste into a patient's knee and, because the paste is malleable, move it around so that it coats the joint cavities. The knee would then be exposed to ultraviolet light, which converts the paste to a stiff material that will hold its shape. The biomaterial serves as a scaffold for the body's own cells to regenerate cartilage.

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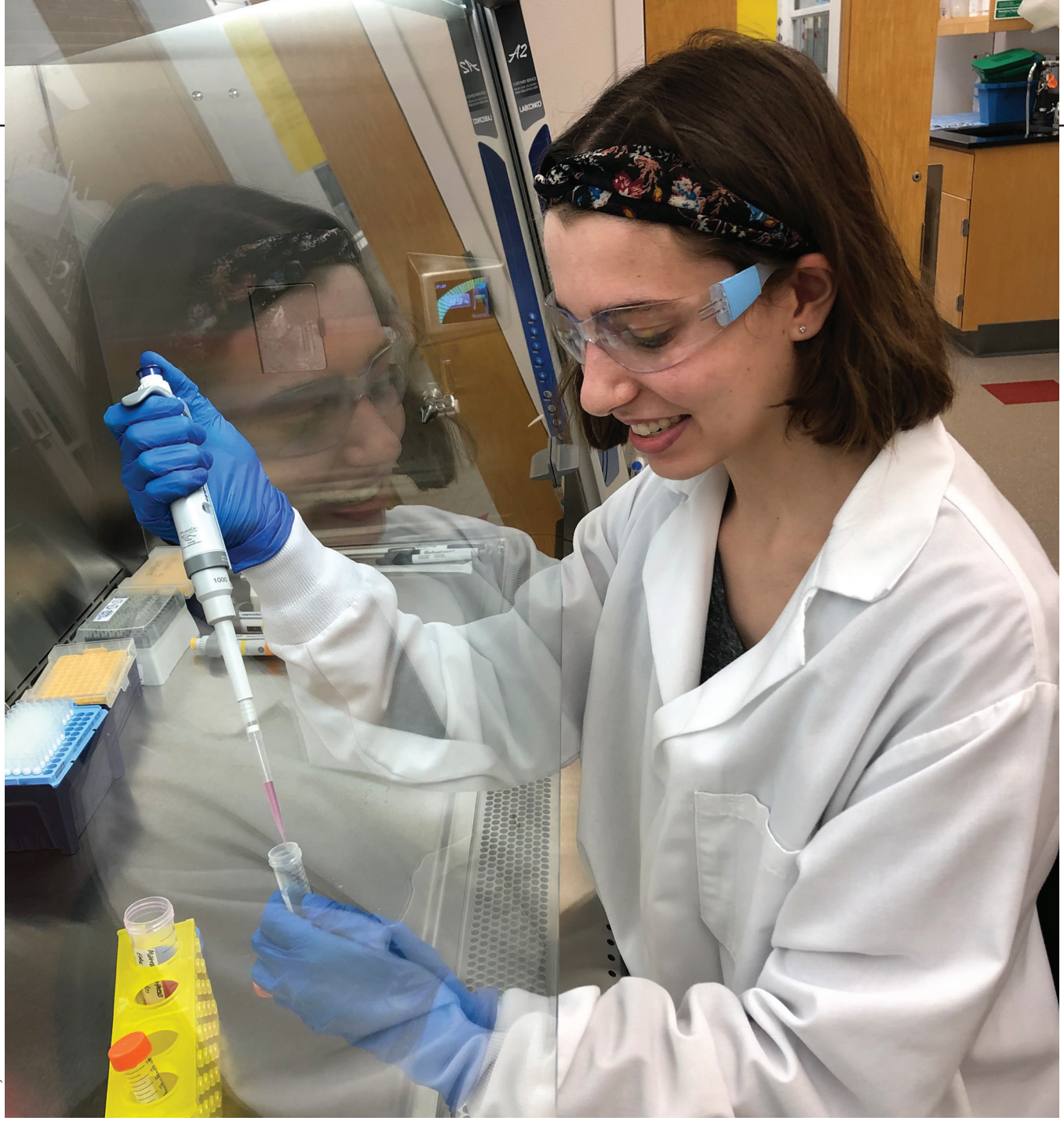
"Because we've made a biomaterial out of cartilage, we have created an environment that encourages the body's own cells to produce cartilage and repair defects," Thomas says.

Other researchers have regenerated cartilage, but Thomas' biomaterial is distinctive because of its mechanical integrity—the stiffness of the material mimics natural cartilage, making the knee better able to bear weight over a longer period of time.

"Emily's accomplishment is like the nursery rhyme—she's helping put Humpty Dumpty back together again," Detamore says. "You can't just give an orthopedic surgeon a piece of cartilage because it won't fit or integrate into someone's knee, nor does the body respond well to synthetic ma-



Emi Kiyotake

Emily Thomas prepares cell culture media for an in vitro study in the lab of Professor Michael Detamore. Through the creation of a unique biomaterial she hopes to stimulate cartilage regeneration.

terials. The surgeon needs something that can fill any defect and help the patient return to normal activity, whether that's playing NBA basketball or working in the garden.

"That's the significance of Emily's accomplishment—because you are regenerating cartilage, the patient won't need to have another procedure later in life."

The research is the topic of Thomas' senior thesis, an invitation-only project and one of her final major accomplishments before heading to the University of Michigan to work toward her doctorate in biomedical engineering. Her success at OU also garnered major national accolades. She received the Astronaut Scholarship and the Barry Goldwater Scholarship, only the fourth student in OU history to win both. She also received a National Science Foundation Graduate Research Fellowship, making her the first student in OU history to win all three.

"Emily is brilliant," Detamore says. "She's been a thought leader in our research group, and her research accomplishments have helped to bring us closer to translating this to the clinic in the future. I'm very proud of her and excited for her next steps as she continues on to her Ph.D. This is just the beginning of amazing things for her."

April Wilkerson is a writer and editor for OU Medicine.