LEADING THE WAY

beyond BARRIERS

As the inaugural Frederick G. Smith, MS, DDS, & Venice K. Paterakis, DDS, Endowed Professor in Oral and Maxillofacial Surgery, Tao Lowe, PhD, is developing drug delivery platforms that transcend boundaries.

BY HOLLY SELBY

Growing up in China, Tao Lowe, PhD, suffered from tooth decay and received multiple fillings that, to her chagrin, came in gold, silver, and black. The experience made the young daughter of chemical engineering professors swear off sugary foods for years — and dream of developing more natural-looking materials that would make her smile beautiful.

Although as a youth she didn't invent a way to ensure what she calls "pretty teeth," Lowe's talent for spotting problems and dreaming of solutions has fueled her career as a scientist.

Today, her nanotechnology research focuses on delivering drug therapies across some of the human body's least-permeable barriers. Her lab at the University of Maryland School of Dentistry (UMSOD) is developing, among other things, delivery platforms that can cross many biological barriers and offer the controlled release of drugs that have the potential to aid patients with a wide range of diseases such as oral cancer and diabetic retinopathy.

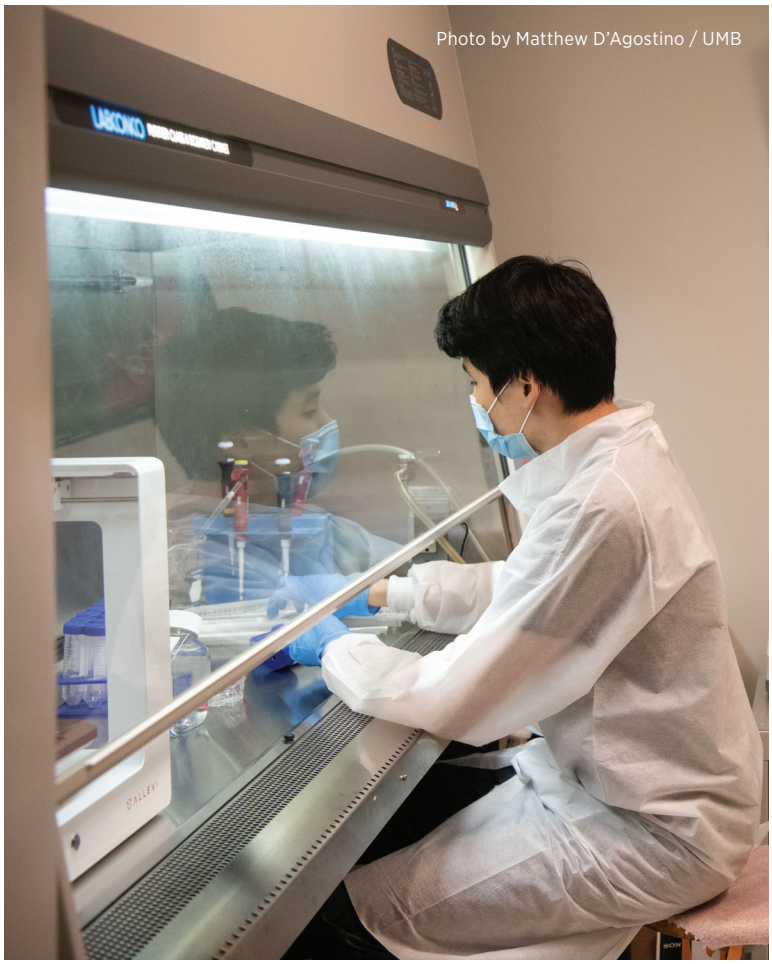
Lowe also is leading UMSOD across an important institutional threshold as the inaugural Frederick G. Smith, MS, DDS, & Venice K. Paterakis, DDS, Endowed Professor in Oral and Maxillofacial Surgery — which is UMSOD's first endowed professorship. Lowe, who holds a joint appointment as a professor in the Fischell Department of Bioengineering at the University of Maryland, College Park (UMCP), has an additional research focus on regenerative medicine and tissue engineering.

Created by philanthropists and School of Dentistry alumni Frederick G. Smith, MS, DDS '78, and Venice K. Paterakis, DDS '81, this first endowed UMSOD professorship marks a path toward greater research collaborations, larger and more rapid advancements in diagnoses and treatments, and transfers of novel discoveries into practical applications. (Read more about Drs. Smith and Paterakis on p. 15.)

The professorship, designed to provide resources to fund the work of an outstanding research scientist in the field of tissue engineering, also supports pioneering translational research and collaborations among UMSOD, the Fischell Department of Bioengineering, and other University of Maryland entities.

"I love my new job," Lowe says. "It offers me the opportunity to leverage the deep clinical knowledge, technology, and research of the Department of Oral and Maxillofacial Surgery, collaborate with other researchers at UMSOD and my peer bioengineers, and connect the dots in ways that are invaluable for translational research."

"Advancing oral health through scientific discovery and commitment to patient care are vital components of UMSOD's mission," says Mark A. Reynolds, DDS '86, PhD, UMSOD dean and professor. "This professorship provides critical support to outstanding faculty research by creating opportunities for new collaborations focused on translational discoveries and clinical advances in oral maxillofacial surgery.



ABOVE: Sangyoon Kim, graduate student in the Fischell Department of Bioengineering at the University of Maryland, College Park and member of Tao Lowe's lab, tests the toxicity of nanogels in retinal epithelial cells.

PAGE 12: Tao Lowe, whose overarching focus is on developing novel biomaterials for translational research, holds eight patents and has two patents pending.

"I am deeply grateful to Drs. Smith and Paterakis for their visionary leadership and support, which will enable us to recruit and retain superlative faculty, and I'm extremely pleased that Dr. Lowe is here at the School of Dentistry."

Lowe came to UMSOD from the University of Tennessee Health Science Center, where she served as an associate professor of pharmaceutical sciences and biomedical engineering in the colleges of Pharmacy and Medicine, respectively.

After earning her bachelor's degree at the Nanjing University of Chemical Technology (now Nanjing Tech University), she received her master's degree in polymer science and chemistry from Tianjin University and a doctorate in polymer chemistry from the University of Helsinki in Finland. Lowe conducted two years of postdoctoral research in the Department of Chemical and Biological Engineering at the University of Wisconsin, Madison. She also served as an assistant professor of surgery, bioengineering, and materials science and engineering at the College of Medicine at Penn State University.

A fellow of the American Association of Pharmaceutical Scientists and the University of Maryland Research Leaders Fellows Program and a recipient of the Coulter Foundation Early Career Award in Translational Research, Lowe holds eight patents and has two patents pending.

Her overarching focus is on developing novel biomaterials for translational research; her lab, as her webpage notes, aims (among other things) to develop new biomaterials that offer "exquisitely sensitive" biodegradable platforms capable of the targeted delivery of therapeutic agents to the sites of oral, craniofacial, ocular, central nervous, cancerous, alveolar, or musculoskeletal lesions.

As a postdoctoral candidate seeking to develop her own professional path, Lowe says, she realized that "biomaterials for drug delivery and tissue engineering became a nice bridge connecting all my training — but also formed a new direction for the future."

Since arriving at UMSOD in 2020, she has established a robust research laboratory, providing training for 20 postdoctoral researchers and dental, medical, and graduate students. She also teaches a biomaterials course to undergraduate students at UMCP that explores the use of biomaterials for oral, craniofacial, and other applications.

In an ongoing National Institutes of Health-funded project, Lowe's group, some of whose members worked with her in Tennessee, has developed an injectable, insulin-loaded nanogel that is able to cross the blood retina barrier and allow a sustained, localized release of insulin to treat diabetic retinopathy (DR).

A condition that can cause blindness, DR affects 14 percent of the 29 million Americans with diabetes ages 20 to 74. It is difficult to treat because of blood ocular barriers, which prevent substances including drugs from passing through to the retina.

Lowe's nanogel technology, delivered via single injection, can cross that barrier and eliminate the need for myriad invasive treatments that can damage surrounding tissues. Lowe hopes this nanotechnology will one day be used to treat DR and other ocular diseases, from glaucoma to age-related macular degeneration.

In addition to developing nanotechnology for sustained drug delivery, Lowe's lab is developing 3D-bioprinted scaffolds — using cells and biomaterials to create bone and nerve-like structures of the face and mouth — that allow living cells to grow and function.

"Our focus is to create a microenvironment that can mimic the extracellular matrix in our body to provide chemical, physical, biological, and mechanical cues for cells to grow and differentiate to repair damaged tissues such as bone, cartilage, and nerve," she says.

Lowe already is involved in several collaborative research projects with UMSOD, UMCP, University of Maryland School of Medicine (UMSOM) colleagues, and others.

She is working with Curt Civin, MD, UMSOM's associate dean for research and director of the Center for Stem Cell Biology and Regenerative Medicine, to use nanotechnology to develop a way to deliver a potent drug for leukemia that was developed by Civin's lab.

In another collaboration, Lowe again is working with Civin as well as Robert A. Ord, DDS, MD, chair of UMSOD's Department of Oral and Maxillofacial Surgery, and John Fisher, PhD, chair of UMCP's Fischell Department of Bioengineering, to create a 3D bioprinting of a cheek organoid to be used to repair defects caused by noma, a gangrenous condition that affects the mouth, nose, and lips.

Saying that she is settling in nicely, Lowe feels pleased with her new home.

"My brain is constantly going, and I love to solve problems. The fun part of doing research is really to identify problems and solve them," she says. "Things are all good except that I have been extremely busy and need to find time to sleep."

PHILANTHROPISTS SMITH AND PATERAKIS ESTABLISH

UMSOD'S FIRST ENDOWED PROFESSORSHIP

Renowned philanthropists Frederick G. Smith, MS, DDS '78, and Venice K. Paterakis, DDS '81, have been committed for decades to working to improve the human condition and serve the public good.

In 2015, the couple donated $1.5 million to establish the first endowed professorship at the University of Maryland School of Dentistry (UMSOD), where they met as dental students in the late 1970s. In endowing the professorship, their aim was to support UMSOD's efforts to recruit a prominent faculty member who would pursue new areas of research and innovative teaching methods.

"I'm proud to be able to play a role in enhancing the quality of the education that will be provided to future students," Smith said. "The goal is to attract someone who can be creative enough to establish a revenue stream for the School of Dentistry, primarily through research and discovery, and that those advancements would also help improve the oral and overall health of the general public."

Their generosity has enabled UMSOD to name Tao Lowe, PhD, as the school's first endowed professor. Lowe will be celebrated as the inaugural Frederick G. Smith, MS, DDS, & Venice K. Paterakis, DDS, Endowed Professor in Oral and Maxillofacial Surgery at an investiture ceremony later this year.

Lowe, who holds a secondary faculty appointment in the Fischell Department of Bioengineering at the University of Maryland, College Park, focuses much of her research on the design and development of multifunctional biomaterials for targeted and sustained drug, gene, and cell delivery. Her investigations and discoveries will enhance UMSOD's clinical and translational efforts in regenerative medicine and tissue engineering, helping to advance oral health and improve lives.

The endowed professorship is by no means the only educational venture the couple has supported. Recognizing that leadership qualities are necessary for future success, Smith in 1996 founded Gerstell Academy, a private school for children in pre-kindergarten through 12th grade located near Westminster, Md. He is chairman of the board of trustees and president emeritus of the nonprofit institution, which teaches a curriculum focused on leadership, college preparatory academics, physical training, and modern language fluency. Paterakis also devotes time to the school as vice president and secretary of the board of trustees, after practicing dentistry.

Smith also serves on the board of trustees of the University of Maryland Baltimore Foundation, Inc., among other groups. Paterakis has been active with Maryland Ronald McDonald House Charities and supports many other charitable organizations such as Yumi CARES and Horizon Day Camps.

Smith and Paterakis, who in 2018 received Honorary Doctor of Public Service degrees from the University of Maryland, Baltimore, are members of prominent Baltimore families and can point to accomplishments in many other endeavors — including business and dentistry.

Smith is vice president and director of Baltimore-based Sinclair Broadcast Group, which owns nearly 200 TV stations across the United States. He practiced oral and maxillofacial surgery in Hunt Valley for more than a decade before joining his family's media business. Paterakis, who practiced dentistry in the Fells Point/Harbor East area of the city for 33 years, is one of six children in a family that rose to prominence in Baltimore through its H&S Bakery business and more recently has been involved in the development of Harbor East.

Noting that she was honored to enhance education at the University, Paterakis said, "Philanthropy and service to the community were values instilled in me at a very young age."