

LIGHT READING

VANDERBILT

BIOPHOTONICS CENTER

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Image by: Jacob Hardenburger

What is this? Learn more on pg. 3!

VIBES PROGRAM

Last summer, the Vanderbilt Biophotonics Center kicked off the Vanderbilt Internship in Biophotonics for Emerging Scholars (VIBES) program. The VIBES program intends to expose students across physics, engineering, chemistry, and biology disciplines to the field of biophotonics. “The goal is to get more undergraduate students interested in optics,” remarks director of the VBC and the VIBES program, Dr. Anita Mahadevan-Jansen. Because there are a limited number of undergraduate programs with a major focus on optics across the country, it’s rare for undergraduates to be offered a chance to explore the rich field of biophotonics. “With outreach and education on biophotonics being one of the core tenets of the VBC, the VIBES program allows us to extend our reach beyond Vanderbilt’s campus.” Beyond research experience, VIBES interns also received weekly professional development seminars from VBC faculty and were given a chance to explore Nashville at various summer intern social events. These events were facilitated by the VIBES planning committee: Dr. Justin Baba, and Ph.D. students Vivian Krause and Nathaniel (Trey) Dobson.

The inaugural VIBES cohort comprised Ishaan Singh, class of ‘27 at Purdue University, and Olcaytu Hatipoglu, class of ‘26 at Tulane University. A double-major in physics and biochemistry, Ishaan knew he was interested in pursuing a summer research experience focused on photonics. While looking around for opportunities, he found that VIBES most closely matched his interests and goals.



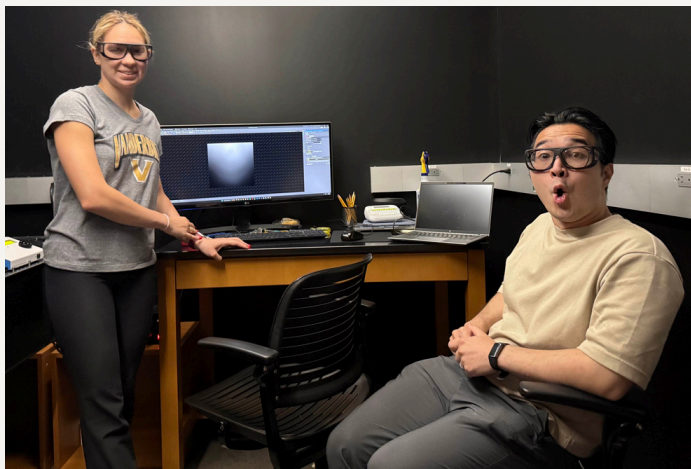
VIBES interns at the poster presentation



VIBES '25 interns joined by other VBC summer undergraduate researchers at Vanderbilt's 14th Annual Undergraduate Research Symposium
Top: (left to right) Jacob Stoeber, Vanessa Omatu, Ishaan Singh
Bottom: (left to right) Rionna Sifferman, Eden Tao, Olcaytu Hatipoglu

Ishaan interned in Dr. Anita Mahadevan-Jansen's lab, performing Raman spectroscopy on pure chemical components to improve spectral unmixing algorithms for characterizing complex samples and work towards a Raman library resource.

During this internship, he also pursued a side project analyzing the point spread functions of specimens in a scanned oblique-plane illumination single-objective light-sheet microscope under Dr. Bryan Millis. Those who worked closely with Ishaan noted his ambition, including his graduate student mentors Ezekiel Haugen and Richard Liao. “Ishaan was very curious and had a lot of drive to pursue various areas of optics during his internship. He was a great addition to the lab,” remarked Richard. Ishaan valued the approachable and patient nature of his graduate student mentors. “They were both really easy to ask questions to,” he shared. “I really enjoyed working with them both!”



Olcaytu and Miguel sharing a eureka moment

Entering her final year of study in biomedical engineering, Olcaytu Hatipolgu applied to VIBES for an intensive experience in optics and translational imaging technologies. “I was drawn to the center’s interdisciplinary approach and its focus on real-world clinical impact,” she commented. Olcaytu interned in BioMIID (Biomedical Microscopy, Immersion, Innovation, and Discovery) under Dr. Bryan Millis and Dr. Miguel de Jesus. Here, her project focused on the development and optimization of a deep-ultraviolet microscope system for label-free biomedical imaging. When reflecting on her VIBES experience, Olcaytu described her “incredibly valuable” relationship with her mentors, emphasizing that they not only provided technical guidance but also encouraged independent thinking. She further remarked that their conversations often went “beyond the task at hand, helping me understand the deeper reasoning behind engineering decisions and pushing me to think critically and independently.”

In turn, Dr. Miguel had this to say about Olcaytu: “It was a great pleasure to work with Olcaytu. She was incredibly driven throughout and quickly picked up essential skills in CAD, fabrication, and hardware integration, which were all critical for her successful internship. She also brought a positive vibe and enthusiasm that Dr. Millis and I enjoyed throughout the summer.”

Beyond providing valuable research experiences and one-on-one mentorship to undergraduate students, a major goal of the VIBES program is to expose interns to the many exciting research areas, graduate programs, and career paths in biophotonics. Being immersed in the VBC’s dynamic and collaborative culture, Olcaytu appreciated the support of VBC members: “Whether it was during lab meetings, one-on-one mentorship, or casual conversations, everyone was open to sharing ideas and offering support.”

“I’ve especially appreciated the genuine interest people have taken in each other’s work—it’s made it easy to ask questions, learn from others, and feel like a real part of the research community,” Ishaan echoed this sentiment, noting that his favorite aspect of VIBES was “interacting with all the people and learning the cool things that happen in biophotonics at Vanderbilt.”

Good VIBES here had at the VBC, and we hope for more in the coming year! The VBC will soon begin recruiting for the second VIBES cohort, with applications going live by November 1st. For more information about program requirements and the link to apply, scan the QR code.



by Vivian Krause



When the sign says ‘Nashville looks good on you,’ we take it personally

Cover page image -SHOCKED Neurons

This image contains a temporal color code of a video of neurons reacting to a shockwave induced using a Q-switched ND:YAG laser. Neurons were stained with Calbryte-520, a calcium-sensitive fluorescent dye, and imaged underneath a widefield microscope using a 20x 1.0 NA objective for 90 seconds. The shockwave was delivered 30 seconds into the imaging. The variations in the colors of the image indicate the time the fluorescence was at its maximum. Neurons labeled in red immediately reacted to the stimulus while more yellow-white neurons activated later in the experiment.

By: Jacob Hardenberger

Zeke Haugen, Ph.D. - Onward to the Next Chapter

“Everyone here is a friend. Walking into the community every day – That’s what I will miss the most,” reflects Dr. Ezekiel Haugen, the most recent Ph.D. graduate of the Mahadevan-Jansen Lab at the VBC. It’s a sentiment that many at the center would echo about him in return.

Known for his calm demeanor and love for fishing, Ezekiel Haugen, familiarly known as ‘Zeke’, was drawn to research during his freshman year as a Physics undergraduate. What followed were research experiences every summer in atomic, molecular, and optical physics, acoustics, and optics, which steered his interest toward biomedical applications. Dr. Haugen spent the past five years at the VBC exploring the limitless diagnostic potential of light, co-mentored by Dr. Anita Mahadevan-Jansen and Dr. Justin Baba. His doctoral research focused on developing a non-invasive, label-free diagnostic tool for eosinophilic esophagitis (EoE) with a focus on pediatrics. This chronic disease affects 1 in every 700 people in the United States. Typical diagnosis and monitoring require patients to undergo sedation while multiple biopsies are collected from the esophagus. This can be burdensome and time-consuming, particularly in children.

Dr. Haugen studied Raman spectroscopy as a non-invasive alternative for EoE diagnosis, using a fiber-optic probe to collect spectral measurements during routine clinical endoscopy. “This technique essentially involves shining light on the tissue and collecting the light instead of having to actually take any tissue out of the body”, he explains. With its sensitivity to molecular bonds, Raman spectroscopy enables the detection of biochemical changes in the tissue caused by EoE. For further validation, he analyzed biopsy samples using high-resolution label-free nonlinear imaging to study the structural and biochemical changes at the cellular level. A central highlight of Dr. Haugen’s research was the development and testing of a novel non-contact probe capable of scanning the esophagus and generating biochemical maps. This design pivot addressed a key clinical challenge, enabling scanning of the entire esophagus rather than relying on manual point sampling, which could potentially improve EoE diagnosis.



Dr. Haugen at his dissertation defense

When asked about the most enjoyable aspects of his research, Dr. Haugen shares how they changed over the course of his PhD. While initially inclined to experiments and building new imaging and spectroscopy systems, he gradually grew to appreciate the writing process. “One of my biggest accomplishments in my research was getting my papers published,” he says, “It’s not much about the papers themselves, but about crossing the finish line, seeing the work through to a point where they are disseminated.” What sustained him through the tougher parts of his PhD? Persistence, the steady support of his advisors and labmates, and most importantly, his family, especially his wife.

Dr. Haugen also enjoyed teaching and mentoring undergraduate students, helping them get excited about science and engineering. He has mentored eight students over the course of his PhD. Beyond technical skills, one of the most valuable lessons he learned was the know-how of clearly defining problems and communicating with those affected by them, whether clinicians or patients.



Zeke working on the MANTIS microscope with Joseph Afreh and Anita Mahadevan-Jansen

He emphasized the importance of listening to those impacted by your technology, and gaining their feedback and perspectives, “because if you don’t, you might end up developing something they don’t actually need.” Dr. Haugen’s PhD journey shaped him professionally and personally in terms of his approach to problem-solving. His advice to new researchers was “Put in an extra hour right when you’re about to quit.” He adds, “But when you have been banging your head against the wall, give it a day, and come back to it anew.”

For Dr. Ezekiel Haugen, enhancing people’s quality of life is his career goal. He is now eager to bring his passion and combined experience to Renishaw, where he is joining as a Raman Application Scientist, to continue working on technologies that make a difference.

by Mahima Sharma

Farewell and Best Wishes to Alex and Shawn

We bid a fond farewell to Alex Cousart, our Clinical Research Coordinator, and Shawn Boggs, our Administrative Manager, as they move on to new opportunities in their careers. Their dedication, hard work, and positive spirit have made a lasting impact on our team and the success of our research endeavors. We’re grateful for all they’ve contributed and wish them both continued success in their new roles.

A promotional poster for the 14th International Conference on Clinical Spectroscopy (SPEC 2026). The background is a night-time photograph of the Nashville skyline, featuring the Nashville skyline with the Nashville skyline, the Nashville skyline, and the Nashville skyline. The text "SPEC 2026" is prominently displayed in large, bold, black letters. Below it, the tagline "LIGHT FOR LIFE: FROM LAB TO CLINIC" is written in smaller, white, sans-serif capital letters. To the right of the main title, the conference details "14th International Conference on Clinical Spectroscopy" are listed in white, sans-serif capital letters. In the bottom right corner, a white box contains the text "SAVE THE DATE" in large, bold, black letters, followed by "NASHVILLE, USA" and "MAY 16-21, 2026" in smaller, black, sans-serif capital letters. A QR code is located in the bottom left corner of the poster.

From Student to Researcher – Anna Funderburg, Ph.D.

Anna Funderburg is a persistent researcher, a dedicated mentor, and a reliable companion on coffee runs. As of July, she proudly earned her doctorate from the VBC. Her research centered on developing a Raman spectroscopy platform for bacterial identification, particularly focusing on the vaginal microbiome. In essence, her work aimed to "use light to detect, identify, and differentiate bacteria."

When reflecting on her proudest accomplishment in the program, Dr. Funderburg highlighted her role as Dr. Andrea Locke's first PhD student and her contributions to establishing the lab. This involved building essential processes for her project, including forming clinical collaborations, writing protocols, and applying for internal grant funding. She also expressed pride in mentoring students ranging from high school to first-year graduate levels, emphasizing her impact on their education. Drawing from her experiences, she advised junior graduate students, "Lack of communication has led to a lot of problems I've faced and that I've seen other students face, whether within the research team or with an advisor. It's okay not to know something, but you need to say it. It's so much better to say something than to try to limp your way through."

Dr. Funderburg's mentorship extends beyond teaching; it is deeply personal. When fellow students face frustration, she would suggest going for a walk or grabbing coffee. She was a founding member of this newsletter, driven by a desire to highlight her peers' work. Conferences hold some of her fondest memories, thanks to the time spent with colleagues.



The Locke lab celebrating after Dr. Anna Funderburg's dissertation defense

Throughout her interview for this piece, she consistently acknowledged the support she received from others, illustrating her belief in the power of small acts of kindness. It's no surprise that when Dr. Funderburg completed her defense, many students, both junior and senior, were moved to tears. She has truly been a cornerstone of the VBC's culture over the past five years.

The next fortunate and caffeine-fueled group to collaborate with Dr. Funderburg will be Dr. Amol Janorkar's lab at the University of Mississippi Medical Center's Biomedical Materials Science Department. This marks a full-circle moment for Dr. Funderburg, who spent two summers working in this lab as an undergraduate. She is eager to return to her biomaterials roots while applying her newfound knowledge of optical modalities for chemical and structural characterization.

by Parker Willmon

Teamwork behind the pages

Editors: Parker Willmon, Vivian Krause, Mahima Sharma & Miguel de Jesus; Layouts: Pratheepa Rasiah

RECENT PUBS, PRESENTATIONS, & AWARDS

Publications

- [“Noncontact Fiber Optic Probe for Clinical Applications of Raman Spectroscopy.”](#)
Sean Fitzgerald, Jay Werkhaven, Anita Mahadevan-Jansen
- [“Subcellular and macrostructural immediate responders to airblast traumatic brain injury”](#)
Pratheepa Kumari Rasiah, Jacob Hardenburger, Han Dong, Andrea Locke, Bryan Millis, E. Duco Jansen, Anita Mahadevan-Jansen
- [“Infrared Neural Stimulation Elicits Distinct Molecular Pathways in Astrocytes Based on Laser Pulse Parameters”](#)
Wilson R. Adams, Ana I Borrachero-Conejo, Pratheepa Kumari Rasiah, Emanuela Saracino, Roberto Zamboni, Eric Duco Jansen, Valentina Benfenati, Anita Mahadevan-Jansen
- [“High-wavenumber Raman spectroscopy for the detection of Mycobacterium tuberculosis in saliva”](#)
Alec B. Walter, Luke Whitehead, Amelia L. Taylor and Andrea K. Locke
- [“Distinguishing Fowler’s and Semi-Fowler’s Patient Postures Within Continuous-Wave Functional Near-Infrared Spectroscopy During Auditory Stimulus and Resting State”](#)
Seth Bolton Crawford, Daniel X. Liu, Caroline Joyce Caveness, Rachel Eimen and Audrey K. Bowden
- [“Naturalistic fNIRS assessment reveals decline in executive function and altered prefrontal activation following social media use in college students”](#)
Anna Aitken, Ali Rahimpour Jounghani, Laura Moreno Carbonell, Daniel Tadeo, Anupam Kumar, Seth Crawford, Audrey K. Bowden and S. M. Hadi Hosseini
- [“Intraoperative Spectrally Encoded Coherence Tomography and Reflectometry \(iSECTR\) for Ophthalmic Surgical Guidance”](#)
Rachel Hecht; Jacob J. Watson; Yuankai K. Tao
- [“Handheld laser speckle contrast imaging probe: quantitative video rate assessment of tissue perfusion in animal and patient applications”](#)
Han Dong, Parker A. Willmon, Pratheepa K. Rasiah, Sean T. Fitzgerald, Emmanuel A. Mannoh, Carmen C. Solórzano, Anita Mahadevan-Jansen

Presentations

SciX 2025 VBC representations

- Viannely Francisco - Investigating clinically relevant biochemical variations in the vaginal microbiome using surface-enhanced Raman spectroscopy
- Alec Walter - 1) Raman Dry Mass: Leveraging High-wavenumber Raman Spectroscopy to Determine Dry Mass Composition of Biological Materials 2) Comparison of Analytical Metrics to Determine Systemic Hydration using High-wavenumber Raman Spectroscopy
- Andrea Locke - 1) Invited talk on Bacteria Sensing in Biofluids Towards Point-of-Care Applications, 2) Session Chair and host of Trailblazers in Analytical Science

Awards

- Alec Walter was awarded the Early Career Travel Award and the Honorable mention poster award by the Coblenz Society
- Audrey Bowden received the Vanderbilt Kennedy Center Nicholas Hobbs Discovery Grant Award of \$30,000. Funding agency- Vanderbilt Kennedy Center (VKC)

FOLLOW US

ANNOUNCEMENTS

VIBES 2026 [applications are live](#), due February 1st

Anita Mahadevan-Jansen was featured in an [interview for Biophotonics Discovery](#)

Justin Baba appointed as Associate Editor for Journal of Biomedical Optics