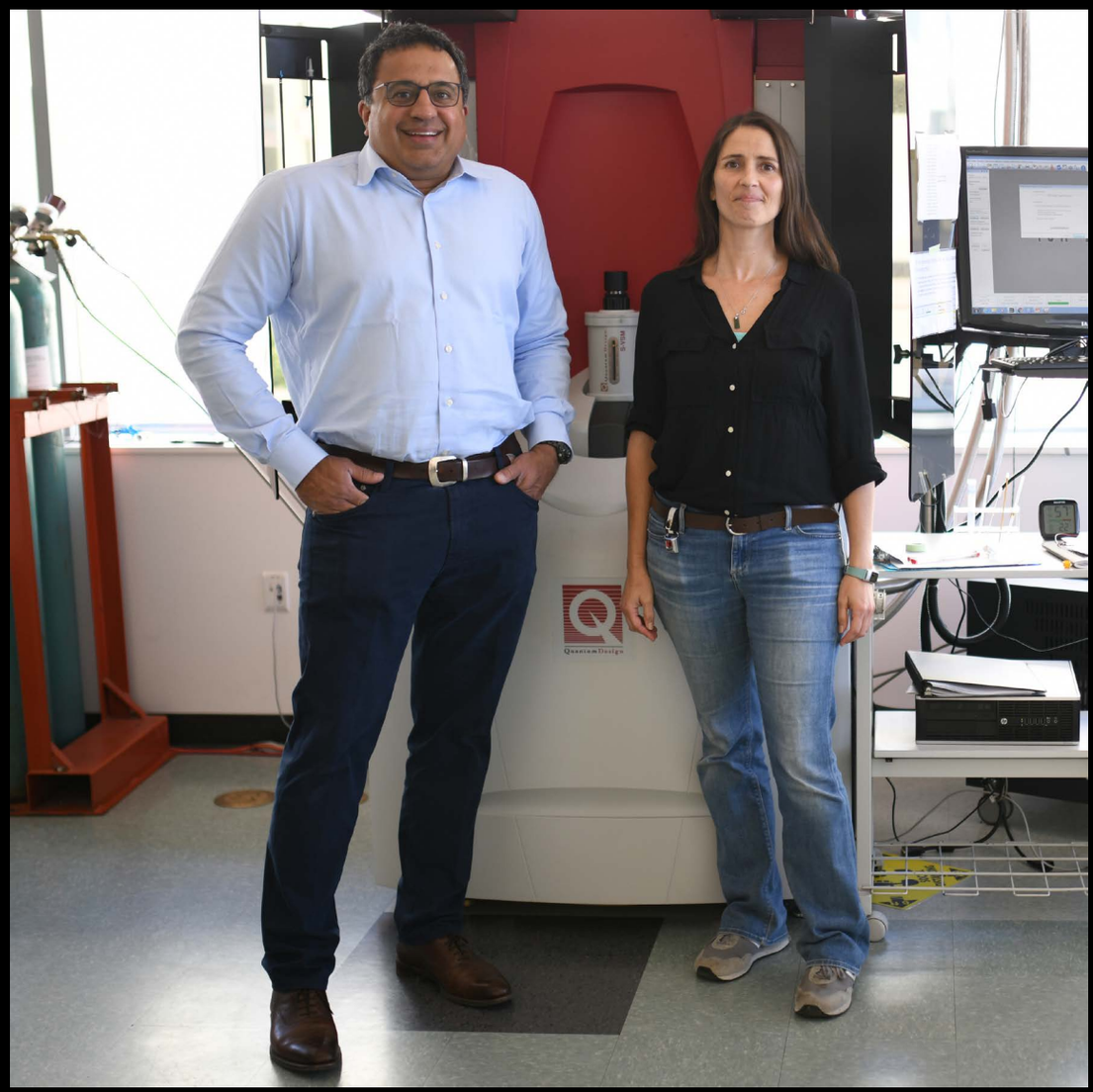
Faculty Q&A



A Conversation with Ram Seshadri

Ram Seshadri and Amanda Strom, technical director of the TEMPO Laboratory, one of eight staffed shared experimental facilities managed by or partnered with the MRL.

Ask **Ram Seshadri** about the UC Santa Barbara Materials Research Lab (MRL), one of the longest-running National Science Foundation (NSF) Materials Research and Science and Engineering Centers (MRSECs) in the nation, and he will talk first about the people involved with it. The MRL director and professor of materials and chemistry will mention the students who are educated there — from UCSB, from high schools in summer, and through exchange programs with universities that have no comparable facility. He'll talk about the faculty, whose research drives the enterprise. And he'll talk especially about the staff who make it all work and whom he considers close friends. "The people do not work for the enterprise," he says. "The people *are* the enterprise."

In his eleven years as MRL director, Seshadri has been involved in leading two rounds of MRSEC proposals, after having served on a third as co-PI when fellow materials and chemistry professor **Craig Hawker** was director. The current associate director (and associate professor of materials), **Christopher Bates,** describes Seshadri as, "an extremely good teacher, demonstrating how to stay proactive in managing a large research team and outreach program by balancing new events and continuously evolving MRL programs to meet the changing needs of the large MRSEC community."

We spoke with Seshadri in August, about a year after the lab received its seventh consecutive round of multi-year NSF funding since being established in 1993.

Convergence: *What do you see as the main focus areas for the MRL at this period of its history?*

Ram Seshadri: The MRL has always had three foundational legs, the first being education and outreach, and we are really happy about where we are with that. As just two examples, the University of California has an NSF grant we participate in called the Louis Stokes Alliance for Minority Participation, which was just renewed for five years, and our PREM (Partnership for Research and Education in Materials) with Jackson State University, in Mississippi, just received its fourth five-year cycle of NSF funding, continuing that long-standing relationship, which includes student exchanges. We have a successful undergraduate summer research program, and many other educational elements.

Another leg of the MRL is our emphasis on facilities. We serve the whole campus — actually, the whole world — by offering everyone access to our facilities, so we always find new challenges there, one of which, currently, is providing enough GPU servers to help our colleagues who work in artificial intelligence [AI] and rely on the affiliated Center for Scientific Computing.

The third leg, of course, is research, without which nothing else would exist. Our current round of funding supports two new interdisciplinary research groups [IRGs). Researchers in IRG One are working on the chemistry of polymers, to improve their recyclability, reusability, and processability. UCSB has been a leader in developing plastics for electronics, but those polymers are extremely hard to process. So, it turns out that determining how to reuse a polyethylene plastic bag and how to better process a conducting polymer are linked.

IRG Two is more about fundamental science, being focused on learning from biology how matter, particularly *active matter* [matter that uses energy to move on its own], is assembled and processed. A famous problem in materials science is how a bunch of M&Ms will pack in a jar. Now, imagine that the M&Ms are moving, like a school of fish. It turns out that these things assemble, pack, and coalesce in ways that obey some very deep fundamental physical laws. Learning from nature and from model systems helps us better understand a range of phenomena in cells, and in structures at larger length scales.

We also award annual seed grants, two of which typically go to early-career faculty. For example, materials assistant professor **Ananya Balakrishna** is using a seed grant to understand how certain crystals change into other kinds of crystals when they are hit with light. How does this happen on a macroscopic scale? How quickly does a change take place? Does it start from one end and go to the other, or does it start in the middle and go out? These are questions about physical phenomena that, again, have important implications in a whole range of applications.

C: *You recently became Associate Dean for Research in the COE. Can you tell us what that position involves?*

RS: Over the past few years, I have found myself willy-nilly advising a lot of groups on how to conduct team research and go after team funding. I was doing this informally but realized that it would be nice to do on a more formal footing so that I could try to point out, particularly to rising early-career faculty, that if they work in teams, they can access far more research dollars than they can in the single-PI mode. In recent years, I've also started pointing out that working in teams is far less lonely, compared to working on one's own as a single PI with a transient population of students and postdocs. Having colleagues gives you people to lean on, to talk to, to share with, to think with, and to secure funds with. Working together is a key strength at UCSB. I have seen places that lack this team spirit, where researchers work in individual silos, and it seems a far less satisfying arrangement.

C: *Are there instruments in the MRL that are more important than others?*

RS: There is a hierarchy of instrumentation that you need for material characterization. Some instruments don't cost very much, and some cost a lot, and if you don't use the inexpensive instruments, it's pointless to use the expensive ones, because no material is ever characterized by one technique. It's a symphony. You need the solo violinist with the Stradivarius, but you also need the triangle, otherwise the symphony doesn't work. (Of course, if you're talking about the *1812 Overture,* you also need the cannon!)

> **"It has always been clear to me that we are only as good as the people we have."**

C: *How do you allot time to all of the various researchers who want to use MRL facilities?*

RS: Anyone can sign up. It's first come, first served, and everyone has equal access. If someone needs more time than was allotted to them or is at a critical point in their research and absolutely must use a certain instrument now, then it's basically a lot of horse-trading.

C: *What is perhaps the biggest challenge that the MRL faces?*

RS: NSF budgets that have been flat over the years, while the costs of students and postdocs and other things have shot up. Not surprisingly, a big priority for me is to ensure that our facilities keep getting renewed and reinvigorated in the face of that.

C: *You have said, "The people are the enterprise." Can you elaborate?*

RS: It has always been clear to me that we are only as good as the people we have. It isn't easy to find good facility staff, and we've been fortunate to have exceptional staff running our instruments. We have ten facility staff members, led by four *technical directors,* and making sure they are happy and not overworked so that we can continue this strong tradition is always foremost in our thinking about the health of the MRL. The longevity among our staff is a matter of great pride to me, and we think it reflects the climate that we strive to accomplish and the quality of leadership throughout the MRL.

We like to tell graduate students we are recruiting that the quality of our facility staff will probably accelerate their PhD by a year. We mean it, and our students know this, which is why at the end of their PhD defenses, they often spend time thanking people who run the facilities. There is not a moment when I'm not grateful for them, personally as well as professionally.

C: *Can you talk a bit about the relationship of the MRL to the Quantum Foundry (of which you are part) and the role the MRL plays in Quantum Foundry research? (See article on page 18.)*

RS: The Foundry does not actually have a general shared facility. They have specialized instrumentation, but they use MRL facilities, of course, as well as those in the Center for Scientific Computing. A main thrust of the Foundry is discovering materials that lend themselves to topological quantum computation, specific classes of materials that have been proposed as model platforms for hosting qubits. We don't know if they'll work, and devices have not yet been made. The field is somewhat futuristic at this point. But, as with so many other things, we're finding that as you study these materials, you learn a lot of very cool physics. Studies of fundamental physics have never gone to waste, and they can lead to very surprising outcomes that nobody anticipates.

C: *What are one or more of your own personality traits that you bring to your role as MRL director?*

RS: When I came to UCSB, then Materials Department chair, **Fred Lange,** said something interesting to me about the MRL director at the time, **Tony [Sir Anthony] Cheetham.** He said, "Tony is a strange person; he'll help you even if he doesn't like you." And that has stuck with me as a trait of good leadership, that you want to see people doing well, and that you help people and are able to separate your ability to help them from whether you like them or not. That's what I strive for; it's up to other people to judge whether I've accomplished this well.

The other quality I think has helped me is that I love science. I'm very curious, and I'm not transactional about acquiring knowledge. I don't say, "Oh, this particular polymer chemistry has nothing to do with my research, so I won't find out about it." Whatever it is, I'm interested.

Last, I don't want to belabor this point, but good leaders should attend to the people in the enterprise, because it's always about the people. It's never about instrumentation. When I show students the great facilities we have in the MRL, for example, our NMR [nuclear magnetic resonance] facilities and our X-ray diffraction facility, I don't tell them that these are the best instruments in the world; I tell them that they are run by the best technical directors in the world, the best staff. I think that's a much more powerful message.