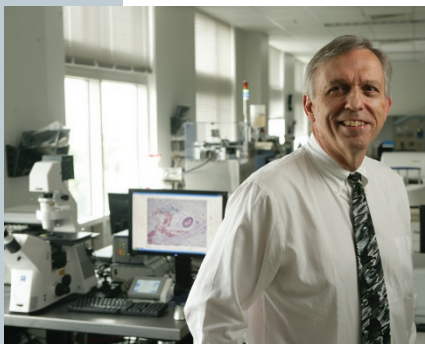


THE AUTHOR FILE

Richard Caprioli

Math, mass spectrometry and imaging can mix, but it takes some woodworking.

Biochemist Richard Caprioli recalls feeling transported to the beginnings of his career when he presented his work to colleagues a decade ago in the gilded amphitheater of the 18th century Caserta palace of Bourbon King Ferdinand. Caprioli



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Richard Caprioli

was receiving yet another honor for his development of imaging mass spectrometry, which gives the instruments the ability to directly analyze and ‘see’ tissues—in terms of both molecular content and that content’s spatial distribution.

In his latest work, Caprioli and his team have found a way to deliver a new multidimensional image predicted from mass spectrometry images and images from other modalities. “It is truly a situation of synergy where the output is greater than the sum of the parts,” he says.

In satellite image processing, researchers can fuse images to integrate data such as thermal signatures. Now Caprioli and his team, including Vanderbilt colleague Raf Van de Plas, apply such mathematical approaches to imaging ‘mass spec’ and microscopy. They take advantage of each modality and minimize the limitations of each, says Caprioli.

Image fusion lets researchers in basic science place molecular information obtained with mass spectrometry onto optical microscopy images. In applied science, pathologists can interrogate a molecular phenotype in new ways, says Caprioli. For example, biopsies associated with kidney disease show dramatic alterations in lipids, which mass spectrometry can detect, but on its own this method lacks the spatial resolution of a microscope. Fused images can offer much more information about these tissues.

Caprioli, who has authored over 300 papers, has appointments in the departments of biochemistry, chemistry, pharmacology and medicine and directs the Mass Spectrometry Research Center at Vanderbilt University School of Medicine. He credits colleagues and students for his achievements and says he chooses collaborators and staff according to scientific intellect and skill, but that he also looks for people whose personality fits into his “lab family,” he says. “Then you stand aside and let them be excellent—you do not micromanage them.”

Biochemist Jeremy Norris says Caprioli motivates people with his approach to science. “It’s difficult to be around him and not catch that excitement about what we’re doing here,” he says. Caprioli was Norris’s PhD advisor. After graduation, Norris joined a company called Protein Discovery, which licensed proteomics technology that Norris and Caprioli had developed. The researchers kept in touch.

Caprioli indeed thinks of his past and present group as a family, says Norris. “He always says once you’re in the family, you can’t leave.” In practice that means he equips people to succeed, sends them on their way and supports their careers even after they leave the lab. Norris returned to Vanderbilt to direct the imaging mass spec center at the medical center.

Caprioli’s talk at the palace of Caserta, as he relayed his excitement about his science to colleagues at Second University of Naples, reminded him of his own PhD defense at Columbia University. He was a young scientist again, sure of a future but unsure about where the road would lead. And as this was mental time travel, he was free of the need to run a lab and find support for lab members and of the worry over whether his defense would be accepted. “For a time in Caserta, I was that young man again but with the advantage of knowing the road I had traveled,” he says. “It was special, really special.”

Caprioli credits his mentor, biochemist David Rittenberg at Columbia University, for teaching him to remember “that however much we think we understand, there will still be surprises, some earth-shaking.” Exploring the cracks and crevices is worthwhile. “Then on occasion, you find something new or a new way of doing things, and it is really elating and satisfying.”

After finishing his PhD at Columbia, Caprioli did a postdoctoral fellowship at Purdue University and landed a professorship there. He was recruited to the University of Texas in Houston and later joined the faculty at Vanderbilt. Caprioli is also editor-in-chief of the *Journal of Mass Spectrometry* and is on the board of the Human Proteome Organization.

When not tending to his numerous duties at Vanderbilt, he enjoys family time. He also does woodworking and makes carvings and furniture, such as an elegant rocking horse for his son made out of yellow pine, ash and white oak. “I find it relaxing and very rewarding,” he says.

Vivien Marx

Van de Plas, R., Yang, J., Spraggins, J. & Caprioli, R.M. Image fusion of mass spectrometry and microscopy: a multimodality paradigm for molecular tissue mapping. *Nat. Methods* **12**, 366–372 (2015).

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