

On entering the Clinical Simulation Laboratory in UVM's Rowell Hall, visitors encounter Harvey, who is coping with myriad heart issues. The good news is, he should be: he's a cardiopulmonary patient simulator who models some of the many cardiac abnormalities a medical caregiver might encounter, and like all of the lab's manikins, Harvey is made of rubber, plastic, and circuitry. Medical students and clinicians push a button near his waist, and through a stethoscope they hear the distinct sounds that signal cardiomyopathy or Tetralogy of Fallot—a ventricular hole in an infant's heart that usually needs to be repaired right after birth—or one of some 30 other heart-related conditions. ▶



Right: Vale Palmadottir, MD, left, and UVM medical student Ronald Masson conduct a resuscitation scenario. Center: Drs. Greg Schulte and Amy Savoy (in yellow) lead an exercise on reviving an infant while students assist.

# Clinical Simulation Laboratory



FLETCHER ALLEN AND UVM GO  
HIGH TECH TO SAVE LIVES



Above: William Raszka, MD, instructs a medical student on venipuncture technique. Center: Tom Peterson, MD, chair of Family Medicine, supervises a central line insertion. Far right: The UVM/Fletcher Allen Clinical Simulation Lab works with various outside groups to provide high-tech training opportunities, including community first responders and members of the Vermont Air National Guard.



Ted James, MD, associate professor of surgery, attending oncology surgeon, and director of Clinical Simulation, says that not long ago, medical students making hospital rounds would be given a vague description (“you’ll hear this murmur . . .”) of, for example, an aortic stenosis. If they happened to chance upon a patient with the condition, the group would rush en masse to place a dozen stethoscopes on his chest to hear it. Now they’re able to call it up on Harvey, with as many as 10 of them listening at one time through a wireless system, picking up the subtle nuances that distinguish that condition from another.

### High-Tech Training

The Clinical Simulation Laboratory is a joint effort by the UVM College of Medicine, the UVM College of Nursing and Health Sciences, and Fletcher Allen Health Care. Dr. James, who assumed his role in

2012, describes it as “the place where the silos disappear, and everyone comes together in this unique space to learn together.” That space includes a virtual reality room; a task trainer room; a debriefing room; a multipurpose room that can serve as emergency room, operating room, or intensive care unit; and mock inpatient rooms. It’s used by medical school students, residents, nurses, and established practitioners. Even housekeeping gets something out of the lab, using the inpatient rooms to train staff on proper cleaning and sterilization techniques.

The virtual reality room houses a handful of machines that allow clinicians and medical students to get comfortable with specific skills: laparoscopy, orthopedics, robotic surgery, and endoscopy. Students are encouraged to complete 10 successful procedures on each of the machines, which would entertain—and challenge—any video-game-loving middle



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schooler. The endoscopy simulator shows a gastrointestinal tract on its monitor; the challenge is to make it all the way to the end without hitting the walls. Success is gauged by an on-screen face that smiles or frowns accordingly. The robotic surgery machine’s challenges include knot-tying that simulates the tying of a blood vessel. They reinforce the hand-eye coordination that’s needed to perform straight stick

laparoscopy, a minimally invasive form of surgery that relies on a microscopic camera.

“It’s about developing dexterity,” says fourth-year medical student Charles Ashley, explaining that surgeons must be able to function in a three-dimensional space that’s visualized in two dimensions on the screen while using tools that can be awkward to manipulate. ▶

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### A Safe Place to Work Out the Kinks

Medical students planning a career in surgery are entered into the Surgery Residency Readiness program (also known as “Sim Lab Boot Camp”), which provides a series of patient care experiences and skills sessions focused on the management of common hospital emergencies. The course was created by Dr. James and several of his colleagues to decrease the anxiety that’s a routine part of the transition to becoming a doctor. Facilitators in the virtual reality room are instructed to create a safe environment so students don’t feel self-conscious about their novice skills.

Next door, torsos and body parts line the shelves of the task trainer room, where individuals and teams simulate countless scenarios including ear exams, bladder catheterizations, and IV placements. “How do you really know that you’re doing these things properly without practice?” asks Dr. James. “You can avoid that learning curve in the hospital, and work out the kinks here instead.”

The lab’s flagship course is in central-line training. The central line, also known as the central venous catheter, is a tube that’s inserted in a vein in the neck or groin and used to deliver medicines and fluids over an extended period of time; infections associated with it are common and can cause patients to become septic. All residents and critical

Left: Director of Clinical Simulation Ted James, MD, leads a biopsy clinic in the Simulation Lab. Below: Manos Soultanakis, MD, (left) and Peter Casson, MD, operate a surgical simulator.

care physicians must therefore learn the best way to place the central line so as to minimize the likelihood of infection. That's been a successful endeavor, says Dr. James; over a 14-month period, FAHC saw infections from central lines drop to zero. That translates to lives saved, illnesses prevented, and some \$5 million in cost savings, all from a "simple training program."


Surgical residents receive the central-line training as part of their July boot camp. They also spend time in the multipurpose room—which serves as OR, ER, and ICU—helping Noelle, Hal, and Hal, Junior, give birth, manage a post-operative bleed or pulmonary embolism, and survive a cardiac event. These high-fidelity manikins blink, breathe, sweat, have adjustable blood pressure and heart and respiratory rates, and even speak (with some behind-the-scenes help from facilitators). Residents also practice on humans acting as patients. Dr. James says students value the course, as indicated on post-boot-camp surveys.

"No one wants to do a bad job, and everyone's worried about that," he says. "So to be able to go through and see what you know and gain confidence in the areas you know, to show what you don't know so you can learn it now and not make mistakes when you get to actual patient care is a huge advantage."

That confidence is reinforced in one of several debriefing rooms, where participants sit down with faculty and facilitators to go over audio and video footage of the procedures they've completed and talk about ways to improve. ▶



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Sometimes that translates to a discussion of how to work more efficiently, but other times, it's more about the dynamics within the team, including showing respect on all sides. "When it comes to quality and efficiency," Dr. James says, "as much as the technical skills are important, it's the communication and the teamwork that make the difference between good and great."

There's been a concerted effort to move toward interprofessional education in the lab, and Dr. James encourages teams of doctors, nurses, respiratory therapists, and others to take part in the trainings together so as to best simulate real-life scenarios.

### Beyond the Lab Walls

Dr. James and his colleagues have been engaged in outreach beyond the walls of UVM and FAHC, as well as coming up with ideas for using the manikins with nonmedical personnel. In the future, Dr. James plans to work with schools on a program to show the consequences of texting while driving, and he will work with humanitarian organizations to develop a training program to teach doctors, police officers, and others to recognize victims of human trafficking.

Facilitators are also taking the simulations on the road through the "Simulance," a fully functioning ambulance that travels to other hospitals with, for example, a manikin as a gunshot victim riding in the back. As at FAHC, the Simulance allows ER units a chance to assess their own practices.

Teams from other hospitals have visited the lab for training, and the Director of Operations and Simulation Education, Dr. Cate Nicholas, and others have traveled to other hospitals to provide training. Facilitators have worked with the Vermont National Guard to provide training in trauma and combat casualty care. And Dr. James is looking into unusual circumstances within the medical system that are outside the operating and emergency rooms, such as how efficient the hospital's response system would be if someone had a seizure in the FAHC cafeteria. At this point, he says, every medical specialty has something to gain from the lab.

"There used to be the saying 'see one, do one, teach one,'" he says, "but the real idea should be 'train, reach proficiency, and then go out to the patients.' We're trying to change the paradigm through simulation." ❁



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# HEART



Joseph Schmoker, MD (left)  
Harold Dauerman, MD (right)

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