GETTING RESULTS
SUCCESS IS A METHOD IN SCIENTIST'S LAB

Dr. Kullervo Hynynen is in the lab, but not for the reason he'd like to be. It's a photo shoot, and the photographer is encouraging him to look natural among vertical racks of green circuit boards. Hynynen uses the time to talk science with postdoctoral fellow Dr. Laura Curiel and scientist Dr. Rajiv Chopra, who will collaborate with him and share a newly renovated 3,600-square-foot lab on the seventh floor of Sunnybrook's C wing.

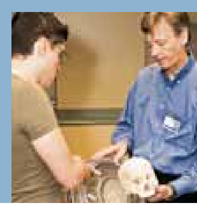
The lab is unique at Sunnybrook. Since arriving in January 2006, Hynynen has recruited 14 lab members, and expects to double that number in the next six months. By autumn 2007 there will be 35 students, postdocs, engineers, tissue culture assistants, animal technicians and research assistants—about the size of his previous lab at Harvard—engaged in 12 research projects.

Chopra, in his office down the hall, says, "The group gets so big because Kullervo focuses on a number of areas to get the work into the clinic." For focused ultrasound therapy of brain tumours, he explains, one team calculates algorithms on wave distortion and refocusing inside the brain. Another handles electronics driver development—how to get signals to sound transducers in the MRI unit. Yet another makes the transducers. Then there is a major effort in preclinical evaluation of prototype devices. "It's the whole spectrum of research," says Chopra.

While the range of activity in Hynynen's lab is unusual, his interaction with his staff is most striking. "One thing that sets Kullervo apart is communication," says Chopra. "He doesn't sit isolated from the students." Students face agonizing forks in the road during experiments, and Chopra admits that there's something to be learned from going down the wrong path, seeing it and coming back. But at the same time, he says with some understatement, "You don't want to make your career out of it. Kullervo really uses his experience to guide his students."

Curiel, recently arrived from France, agrees. "It's astonishing he finds time to speak with each person in the lab, often every day…to check progress and make suggestions." She believes this unusual for an established scientist, but is grateful that he does so. "It saves a lot of lost time," she says adamantly.

Hynynen's short commute from his new home close to Sunnybrook helps him to find time, as does a daunting schedule of dawn-until-dusk workdays. But Hynynen nonchalantly regards the hours and the complex range of his work as requisite for his ultimate goal—clinical implementation. JO



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skull." Remarkably, these corrections produced enough focused heat to destroy tumour tissue.

By 2002, Hynynen and colleague Dr. Greg Clement had constructed a helmet-shaped 320-element array to achieve a more precise application in human skulls. They developed wavevector-frequency models to dictate sound delivery; these allowed for reconstruction of a more sharply focused beam after distortion. Hynynen is now starting clinical trials of these models at Toronto Sunnybrook Regional Cancer Centre (TSRCC) to treat brain tumours—no hair out of place.

MRI-guided ultrasound is adaptable to treat tumours in other areas of the body, and Hynynen was the first to show its potential in the breast. In 2001, Hynynen was a part of a group that eliminated benign tumours up to 6.5 cubic cm. Ablated tumour tissue was absorbed by the body with no adverse effects. He has since collaborated with other scientists in applying this technique to the more complex challenge of cancerous breast tumours. Results are promising, and Hynynen plans to start a clinical trial at TSRCC with SRI scientists Drs. Greg Czarnota and Peter Burns next year.

Three in four women will develop uterine fibroids at some point in their lifetimes, and one in four will experience symptoms, which include pain, bleeding and infertility; they're also the main reason for hysterectomy. In 2003, Hynynen and collaborators zapped uterine fibroids up to 10 cm in diameter in a clinical trial. The procedure took less than three hours, produced only mild discomfort, and patients were released immediately. The treatment is now federally approved in the United States and Canada. Despite the bureaucratic frustrations of pushing the treatment into the marketplace, its success is the accomplishment that pleases Hynynen most. "I'm very happy ultrasound surgery is now in clinical practice—it will most likely make a huge difference in the lives of people," he says.

While Hynynen is pleased ultrasound surgery is finally a clinical reality, he believes his work on disruption of the blood-brain barrier holds the most promise. The blood-brain barrier is a membrane that controls movement of substances between blood and the central nervous system. In 2001, Hynynen and his lab were the first to use MRI-guided ultrasound with microbubbles as cavitation nuclei to open specific parts of the barrier—a feat thought impossible by many scientists. The preclinical procedure required removal of skull bone, but was done at relatively low frequency, thus leaving surrounding tissue intact and ensuring the opening was transient. In 2004, by combining this technique with earlier work on algorithmic correction of distorted sound waves, the team achieved the same effect noninvasively. Clinical translation of this procedure could have profound implications in brain cancer and other diseases of the nervous system for which treatment is difficult or even impossible.

Hynynen is keen to get into the lab. End of interview in sight, he becomes almost expansive looking back at his career. On developing an interest in science during high school in Finland, he recalls, physics quickly became his strongest subject. At the University of Kuopio, he was accepted in all physics streams, but says, "Medical physics seemed to be the area which could most benefit others. That was a deciding factor, and it felt right." Interview over. Standing up, Hynynen laughs, adding, "There are easier choices where you make more money, but I'm happy and have never looked back." JO