

Research Revolution at McGill University's Faculty of Dentistry

In 1991, McGill University announced that it would be shutting down its faculty of dentistry. While no one doubted the quality of education provided by the faculty, the university was asserting itself as a research-intensive institution. Although a small handful of excellent investigators were still active, the faculty of dentistry produced relatively little research overall. But thanks to a concerted and very public effort by faculty members and supporters, the faculty of dentistry at McGill University was saved. In 2008, the faculty is still here, but with a major difference.

"Today, we're at the point where our research is among the best for any dental school anywhere, based on widely accepted research metrics," says Dr. Marc McKee, the faculty's associate dean of research. "We have a very small faculty, but if you count on a per capita basis grant dollars, publications, salary awards, national and international leadership positions, prizes and research awards, we most certainly rank among the top dental schools in the world."

At the Forefront of Research

The transformation has been stunning. In 2006–07, projects on which McGill faculty of dentistry researchers were lead or co-investigators received almost \$9 million in funding; when salaries and student support are included, support for research surpassed \$13 million (compared to less than \$1 million in 1998–99). Since 2005, over 100 publications per year have listed McGill dentistry in the author affiliations, more

than double the total in 2001. In addition, the faculty's operating grants and contracts grew from 33 to 67 between 2001–02 and 2006–07, and its graduate student population has also doubled since 2000. This explosion of activity has propelled McGill's faculty of dentistry to prominence on the Canadian and international research scenes, even without the per capita proviso. About one-third of all funded oral health-related research in Canada is carried out at McGill, despite being home to only 5% of Canada's dentistry professors.

Over the past 10 years, because of retirements and university growth in certain areas demanding faculty renewal, and with the assistance of the Canada Research Chairs program, the faculty has hired 15 new tenure-track professors with active research programs. Both established researchers and rising young stars have been recruited from across Canada, the United States and Europe.

Establishing Research Priorities and Partnerships

The research is paying off with some major breakthroughs. For instance, Dr. Jake Barralet's work developing novel bioceramics and processing methods for bone grafts could change the way craniofacial and other osseous reconstructive surgery is carried out. Dr. Marc McKee's recent research on molecular determinants of calcification of bones and teeth, with applications to limiting debilitating pathologic calcification of soft tissues such as arteries in atherosclerosis, has been widely reported. Dr. Jocelyne Feine's research showing the health benefits of overdentures supported by 2 implants has also had a significant impact in the oral health field.

These successes, among others, can be attributed to a number of factors, including a set of research priorities that address some of the most compelling questions in dentistry today. Under the guidance of Dr. James Lund, former dean of dentistry, the

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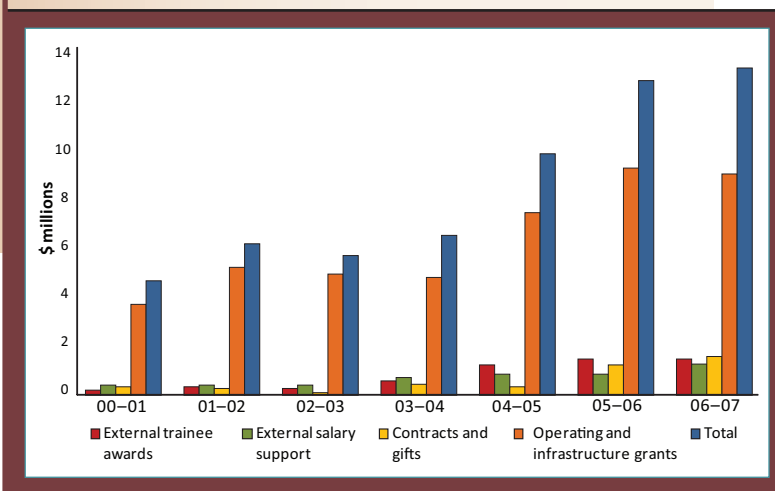
Dr. Marc McKee, associate dean of research

faculty has built 4 pillars of research: 1) clinical and health services, 2) pain and the neurosciences, 3) biomaterials, nanobiotechnology and tissue engineering, and 4) mineralized tissues and extracellular matrix biology. Each area is associated with one or more research networks or centres, so that professors and their teams of post-doctoral fellows and graduate students can draw on the university's wide-ranging expertise for interdisciplinary research that investigates the health care challenges facing dentists and their patients. Teams of like-minded, energetic and innovative senior and junior researchers focus their research efforts in an interdisciplinary way that is strongly supported by the new dean of dentistry Dr. Paul Allison, former dean Dr. Lund, by the deans of other faculties and by McGill's central administration.

Examples of this synergy are seen in the various collaborations facilitated by McGill's research centres of excellence, which bring together dentistry professors with colleagues in the faculties of medicine, science and engineering. For instance, McGill's researchers in oral health explore access to care, the causes of oral diseases and ways to improve oral health and quality of life, focusing in particular on infant caries, oral cancer, edentulism (especially prevalent among older residents of Quebec) and the relation of poverty to oral health. This involves collaborations with dentists, other health care professionals, government organizations and community-based groups, who work together at developing and testing ways to improve implant-supported dentures, address the needs of underprivileged populations, identify

risk of caries in preschoolers and develop prevention strategies, and improve the quality of life and survival rates of patients with oral cancer. McGill's researchers are also involved with the Network of Oral and Bone Health Research, which joins over 50 researchers across Quebec. Similarly, the Alan Edwards Centre for Research on Pain, housed in the faculty of dentistry and directed by Dr. Catherine Bushnell, unites dentistry faculty with researchers from the faculties of medicine and science to explore the factors causing chronic pain, from physiological to environmental, dietary, genetic and psychological influences, and provide therapies to alleviate pain. McGill's pain research spans clinical and laboratory research and has achieved international renown. Today, it is recognized as one of the world's leading pain research units.

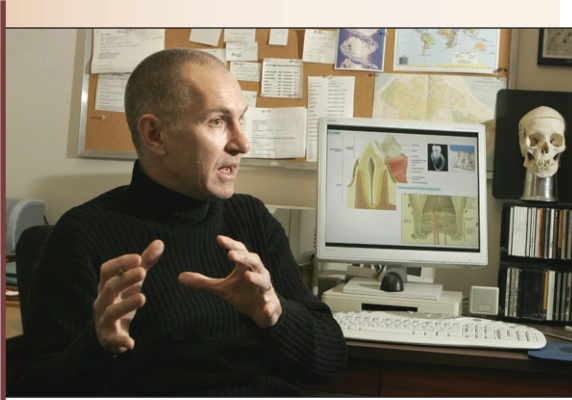
Biomaterials and tissue engineering researchers in dentistry are developing technologies and materials (often at the nano scale) to address problems of bone cementing or reconstruction, salivary gland regeneration, or bioactivation of implants, all of which address problems of diagnosis and treatment, provide early diagnosis of some diseases by detecting chemical changes, or provide new materials and regenerative strategies to treat patients and speed recovery times. Much of this work is carried out with scientists from the fields of medicine, science and engineering through multidisciplinary centres such as the McGill Centre for Biorecognition and Biosensors, the McGill Facility for Electron Microscopy Research and the McGill Institute for Advanced Materials. Finally, the faculty's mineralized tissues and extracellular matrix biology researchers investigate skeletal and dental biology in order to develop therapies to ensure healthy bones and teeth and understand and treat connective tissue disorders. Based primarily in the McGill Centre for Bone and Periodontal Research as part of the Jamson T.N. Wong laboratories, these researchers work closely with their peers in other faculties, as well as with members of the biomaterials research group.



Research stipends for graduate students, postdoctoral fellows and professors, as well as direct grant support for research. Additional income from the Canadian Foundation for Innovation and from large multi-investigator grants is not included.

Success Breeds Success

These research groups have evolved through gradual hiring processes, with 1 or 2 people becoming well-known in their fields and then attracting more top-flight



Dr. Marc McKee's recent research focuses on the molecular determinants of calcification of bones and teeth.

researchers interested in absorbing the vibrant intellectual environment. "Each of our 4 strengths has strong senior researchers with plenty of enthusiasm, as well as international reputations, and this in turn acts as a magnet for recruiting new, more junior academics," stresses Dr. McKee, who came to McGill in 1998. Dr. McKee is one of only a few to have received 2 Distinguished Scientist awards from the International Association for Dental Research for his research on biomineralization, bone remodeling and enamel maturation (the 1996 Young Investigator award and the 2003 Regulation of Biological Mineralization award). In addition, because interdisciplinary collaborations are so important to contemporary dental research, many recruits are joint-appointed with other faculties. Dr. McKee is joint-appointed in the faculties of dentistry and medicine (anatomy and cell biology), as are Drs. Gary Bennett (anesthesia), Catherine Bushnell (anesthesia), Fernando Cervero (anesthesia), Maryam Tabrizian (biomedical engineering), Dieter Reinhardt (anatomy and cell biology), Ji Zhang (neurology and neurosurgery) and Monzur Murshed (medicine).

Extending Knowledge Beyond the Scientific Community

While McGill's researchers are leaders in their fields, it remains important for them to make clear how their efforts will translate into enhanced treatment and improved oral health. "In general, researchers have not been very good at explaining the significance of their work to health professionals, to patients, to the media and to the public at large," Dr. McKee admits. "But at McGill we're learning to be interactive and proactive about implementing ways to translate this knowledge beyond just the scientific community."

The faculty is addressing this knowledge translation gap through everything from websites explaining research goals and health care objectives the researchers are striving to meet in the next 5 to 10 years, to newsletters explaining the latest breakthroughs.

In addition, the faculty's continuing education sessions now include a research component wherever possible. Recently, Dr. McKee participated in a session where he discussed how research on bone biology is translating into ways to help dentists determine if a patient is able to retain a dental implant. Other faculty members have done similar sessions, and this innovative proactive participation of investigators in the continuing education program ensures that recent key research findings are integrated into clinical updates for practising dentists.

Meanwhile, undergraduate dentistry students can participate in summer research programs and attend lectures on how to critically assess research literature, so that they will enter the profession with a better sense of the relationship between research and clinical practice, as well as an enhanced capacity to evaluate research claims and provide evidence-based care to their patients. The faculty is currently considering ways to include patients at scientific conferences so that problems can be discussed from the points of view of the patient, dentist and researcher.

"Some of our ideas are still in their infancy, but we're trying to find the best ways to educate the public, patients and dentists about what we do," says Dr. McKee. "We're getting researchers to speak to students and dentists about the implications and clinical potential of their work, and there is a lot of enthusiasm around these discussions. The more all these groups talk together, the better it is for everyone." ♦

THE AUTHOR

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More information on the research programs, objectives and publications of the faculty of dentistry at McGill University can be found online at www.mcgill.ca/dentistry/research.