The 2007 CDA/Dentsply Student Clinician Research Program took place on May 25 in Jasper, Alberta, in conjunction with the CDA Annual Convention.

This national clinical research competition is open to one dental student from each accredited dental school in Canada. It is designed to stimulate ideas, improve communication and increase student involvement in the advancement of the dental profession.

The program is an excellent opportunity for dental students to display their research skills in a national forum. Student clinicians provide a brief presentation of their research table clinic to a panel of qualified judges, and winners are selected on a total points basis.

This year, first prize was awarded to Sean Robertson from the University of Toronto for his research project on characterization of the components of partially purified human bone morphogenetic proteins using mass spectroscopic based protein identification. As part of his award, Mr. Robertson will present his research project at the 2007 American Dental Association Annual Session in San Francisco, California.

“It's an honour to have been chosen to represent CDA at the ADA Annual Session in September,” says Mr. Robertson. “I am grateful for the opportunity to share this research with an international audience and look forward to collaborating with clinicians and dental students at the conference.”

Second prize, consisting of a $1,000 cash award, went to Michael Sorek of McGill University for his research project on the validation of the photodynamic disinfection efficiency of the Periowave system.

The Student Clinician Research Program was once again sponsored by Dentsply International and managed by CDA. Dentsply generously provides the prizes along with the airfare and travel expenses to the conference for the qualifying students.

“Dentsply is really proud to partner with CDA to support the Student Clinician Research Program,” says Dr. Linda Niessen, vice-president and chief clinical officer of Dentsply International. “Research is critically important to the future of the profession because without a solid research base, you don’t have a profession. The best way for the next generation of dentists to appreciate how important research is to their future is for us to support their research activities today.”

A great deal of time and preparation go into these research projects, but in Mr. Robertson’s opinion, it is worth the effort.

“This is a great opportunity to take the research a little bit further with the emphasis on its clinical importance,” he says. “We are trained to be evidence-based in our thinking and to resort to literature to make clinical judgements. I think that we learn and appreciate this so much more when we take an active part in creating and evaluating that evidence through research initiatives.”

Most of the student clinicians who participated in this year’s program hope to continue doing clinical research in the future and recognize the opportunity it provided to share their research with peers and future colleagues. Landon Pincombe and his project partner, Carman Rabuka, from the University of Saskatchewan, felt that the program also gave them the chance to get a sense of the process of performing clinical research.

University of Toronto Student Wins Student Clinician Research Program

Sean Robertson and Michael Sorek, first- and second-place winners.
“Dentistry is evidence-based so as practitioners we draw a lot of what we do from research,” says Mr. Pincombe. “I think it’s been a really valuable experience to know what is involved. This program gives us an idea of what the people doing research go through.”

For some students, figuring out the research process also involved learning to use the latest technology. Darya Dabiri, from the University of British Columbia, chose her particular research project because it not only encompasses many areas in dentistry, but also uses many different instruments and techniques, including fluorescent imaging, which is a relatively new area for dentistry.

Second-prize winner Mr. Sorek values the importance of research keeping practitioners up-to-date on new developments in the field. “It’s only through research that we can advance dentistry,” he says. “This program gives us the opportunity as clinical researchers to go beyond basic dental work and into a greater depth of dentistry.”

Likewise, Emma Jakmakjian, from the University of Montreal, believes that without the desire to explore dentistry via research, the field would not advance. She often quotes a former professor of hers, Dr. Arto Demirjian, who told her, “Practice is the body of our profession, but research is its soul.”

Dr. Niessen agrees. “As the students become practitioners, because they’ve had this research experience, they recognize that throughout their 30- or 40-year career there are going to be new scientific advances that will actually change their approach to patients and how they provide dental care,” she says. “From my perspective, this is a fabulous program that really is supporting the next generation of dental leaders.”

Dentsply currently sponsors student clinician research programs open to dental students in 35 countries on all 6 continents.
JCDA is pleased to publish condensed versions of the abstracts submitted for the CDA/Dentsply 2007 Student Clinician Research Program. To qualify, the study must fall under the categories of “clinical application and techniques” or “basic science and research.” Students must identify the purpose of the study, provide background information, outline how the study was conducted, and report on the results of the study and its possible significance. The student, selected by his or her own faculty, must be an undergraduate at the time of the presentation, as well as a member of CDA. Nine dental schools participated in the competition this year.

**1st Place**

**Characterization of the components of partially purified human BMP using mass spectroscopic (MS) based protein identification**

*By Sean G. Robertson, S.A.F. Peel and C.M.L. Clokie, University of Toronto*

Morbidity and limited supply of bone autograft has led to the increased use of recombinant human bone morphogenetic proteins (rhBMP) to stimulate bone defect repair. However, very high concentrations are required because of poor retention of the rhBMP at the wound site. In comparison, partially purified BMP (BMP/NCP), which is relatively insoluble, is approximately 10 times more active than rhBMP.

The researchers hypothesized that some of the non-BMP components bind to BMP, reducing its solubility and increasing its bioactivity. The aim of this study was to identify the components of BMP/NCP from purified human (h) and bovine (bv) bone using MS-based protein identification. MS analysis was performed by the Advanced Protein Technology Centre at the Hospital for Sick Children in Toronto, Ontario. The identification of the NCPs was achieved through comparison with 2 public databases (MASCOT, GPM).

The results confirmed those of other studies which reported that SPP-2, α(β)-crystallin, MGP, dermatopontin and lysyl oxidase were present in BMP/NCP. In addition to identifying major components of human and bovine BMP/NCP, the study identified 4 new proteins: chondroadherin (bv, h), thrombospondin-1 (h), PRO1708 (h) and KIAA1662 (h). The results of this research permit the investigation of the effect of each NCP identified on rBMP solubility and activity.

**2nd Place**

**Validation of the photodynamic disinfection efficiency of the Periowave system**

*By Michael Sorek, J. Zylbering, P. Lebel and V. Benhamou, McGill University*

Research has shown that oral bacteria can be killed by light in the presence of a suitable photosensitizer. The Periowave photoactivated disinfection system created by Ondine Biopharma uses a low-intensity red laser and light-activated compound (methylene blue) to kill periopathogens and reduce the symptoms of periodontal disease.

The aim of this study was to determine the susceptibility of certain bacteria to photodynamic sterilization and the exposure time needed to kill the bacteria with the Periowave laser. Multiple species of planktonic bacteria were irradiated with the Periowave laser in the presence of methylene blue; the controls examined the effects of light and methylene blue alone. One species was subjected to different time intervals of irradiation.

The study concluded that all planktonic species tested are susceptible to irradiation but that some species are eradicated to a greater extent than others. In bacteria found in plaque, anaerobic species are more susceptible to photodynamic desensitization than aerobic bacteria. Finally, the data suggest that with some species, total eradication can be accomplished with shorter exposure times.

**Hand hygiene: rub it in**

*By Matthew Gilchrist, Dalhousie University*

Hand hygiene is recognized as the most important measure to prevent health care-associated infections. Although these microorganisms are easily removed by routine handwashing, health care workers’ compliance with hand hygiene standards is unacceptably low.
A literature review was conducted to evaluate the evidence supporting the use of alcohol-based hand rubs as an option for hand hygiene in the health care field. The researcher conducted a survey at Dalhousie University’s faculty of dentistry asking whether these dentists use, or plan on using, alcohol-based hand rubs in their practice, and the rationale behind their choice. In addition, the survey tested the dentists’ general knowledge about hand hygiene and alcohol-based hand rubs.

The literature review revealed that alcohol-based hand rubs are at least as effective as soap and water and other antiseptics in reducing microorganisms on the hands, less damaging to skin, require less time than soap and water washing does, and are associated with improved hand hygiene compliance. However, the survey results demonstrated that dentists’ knowledge regarding hand hygiene and alcohol-based hand rubs is generally poor; the majority of those surveyed did not use these products in their dental practice.

Wounds were created in air–liquid interface (ALI) cultures. Following mechanical injury, both basal and columnar cells express IL-13 and HB-EGF at the wound edge. In addition, p-EGFR is significantly increased at the wound edge in response to injury. p-EGFR and sLex are co-localized immediately after injury at the wound area and sustain their dual expression at the wound edge for 24 hours.

The study concluded that expression of IL-13, HB-EGF, p-EGFR and sLex as biomarkers of AEC repair in ALI cultures supports the researchers’ in vitro data, which demonstrated essential roles for these structures in epithelial repair.

Localization of epidermal growth factor receptor, sialyl Lewis X, interleukin-13, and heparin-binding epidermal growth factor on differentiated bronchial epithelial cells following mechanical injury

By Darya Dabiri, S. Allahverdian and D.R. Dorscheid,
University of British Columbia

This research is supported by the Canadian Institutes of Health Research.

Airway epithelial cells (AEC) are frequently exposed to various irritants that result in epithelial damage. Complete repair is essential as the surface of airway epithelium acts as a barrier against the irritants. Bronchial epithelial cells can produce a diverse array of pro-inflammatory mediators that are actively involved in different stages of epithelial repair.

The aims of this study were to examine localization of HB-EGF and IL-13 in polarized epithelial cells to evaluate their interaction in bronchial epithelial wound repair and to examine distribution of p-EGFR in polarized airway epithelia cells and whether association of sLex (Sialyl Lewis X) with EGFR after injury alters this distribution.

Perceiving the pain of others

By Emma Jakmakjian, L. Budell, M-J. Roy, P. Jackson and P. Rainville, University of Montreal

The objective of this study was to examine the interaction between the experience of pain and the perception of pain in others.

Thirteen subjects (7 men and 6 women) between the ages of 18–25 viewed short movie clips depicting 3 levels of pain-related expressions. Their responses were selected from a visual analog scale representing pain intensity and recorded. Painful stimulation was delivered through a Medoc system using an fMRI-compatible Peltier thermode (3 × 3 cm surface area) positioned on the skin of the inner portion of the leg. Individual stimuli were applied by changing the temperature of the thermode, thus minimizing any tactile cues for stimulus location.

These preliminary data suggest that at least initially, the administration of pain has a tendency to increase the rating of the pain of others. Moreover, the findings from this study have identified that the administration of pain interacts with the repetitive presentation of the same stimuli. Indeed, it seems that the effect of the pain stimuli is
strongly attenuated with repetitive presentation of the same set of stimuli.

Comparative study of the Maxcem (Kerr), RelyX Unicem (3M ESPE) and Panavia 21 (Kuraray) cements
By Dorothée Packwood, Geneviève Gaumond and Audrey-Anne Roy, Laval University

The range of cement materials used for inlays, crowns, bridges, root posts, veneers, etc., currently available on the market can make it difficult to make an informed and appropriate choice about which to use in a given situation. Following a review of the literature, 2 cement materials stand out and appear to be the most popular among dentists: Maxcem (Kerr) and RelyX Unicem (3M ESPE).

The aim of the study was to provide a detailed presentation of the composition, manipulation, and chemical, physical and mechanical properties of the products and to assess their advantages, drawbacks, indications and contraindications. Once the properties of these self-etching materials were established, they were compared to those of a more conventional and widely used resin: Panavia (Kuraray). Their theoretical benefits and indications were then compared in a practical context.

P2X7 receptors act through 2 distinct mechanisms to regulate osteoclast survival
By Jasmina Korcok, Stephen M. Sims and S. Jeffrey Dixon, University of Western Ontario, CIHR Group in Skeletal Development and Remodeling

Osteoclasts express multiple P2 receptors including P2X7, which can induce formation of membrane pores in the presence of low concentrations of divalent cations. P2X7 receptor knockout (KO) mice show enhanced trabecular bone resorption associated with increased osteoclast numbers. Osteoclastogenesis was similar in cultures of bone marrow from wild-type (WT) and KO mice, suggesting that osteoclast survival is prolonged in KO mice.

The aim of this study was to examine whether P2X7 receptors regulate osteoclast survival. Osteoclasts were isolated from long bones of newborn WT and KO mice and samples were assessed for apoptosis and for survival under more physiological conditions. The data indicate that P2X7 receptors act through 2 mechanisms to regulate osteoclast survival. First, activation of the receptor by high concentrations of nucleotides induces membrane pore formation leading to acute cell death. Second, under physiological conditions, activation provided evidence of binding to markers β-tubulin, Vimentin, NFM, GFAP, GALC.

Permanent and deciduous teeth contain progenitor cells displaying multiple morphologies that can be grown in vitro. This study provides preliminary evidence suggesting that stem cells are present within the dental pulp with potential to become mature cells including, but not limited to, collagen-producing cells, neural cells and glial cells. These stem cells are not only derived from a very accessible tissue resource, but may be capable of providing enough cells for clinical applications such as cleft palate closure, neural regeneration and bone grafting.

Stem cell potential from extracted deciduous and permanent teeth
By Landon Pincombe and Carman Rabuka, University of Saskatchewan

The objectives of this study were to investigate the dental pulp tissue as a source of stem cells, to examine differentiation potential, and to test the ability to culture these cells in vitro. Deciduous teeth and permanent third molars were cleaned immediately upon extraction and the dental pulp was removed and sample solutions created. Three out of 14 dental pulp tissue samples demonstrated successful cultures containing cells of different morphologies. One of the successful cultures was obtained from a permanent third molar and the other 2 from deciduous incisors. Immunohistochemical analysis

provided evidence of binding to markers β-tubulin, Vimentin, NFM, GFAP, GALC.

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of P2X7 receptors by low concentrations of constitutively released nucleotides induces apoptosis. The study concluded that the P2X7 receptor reduces bone resorption by decreasing osteoclast survival and represents a potential target for the development of antiresorptive drugs that could be used in the treatment of periodontal bone loss.

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Detection and characterization of surfactant proteins in exhaled human breath

By Xuetao Xie, H. Pasterkamp and J.E. Scott, University of Manitoba

Pulmonary surfactant (PS) is a complex lipoprotein mix that lies at the most peripheral areas of the lungs and generates surface tension within the gas exchange regions to prevent lung collapse. Four surfactant proteins (SP) are present within the PS: SPA, SPB, SPC and SPD, which have important functions related to the surface tension lowering properties of PS.

Changes in protein composition or function have been documented in disease states such as asthma, chronic obstructive pulmonary disease or bronchopulmonary dysplasia. Premature infants born prior to the onset of full PS production develop respiratory distress syndrome. There is also some preliminary evidence that exposure to mold toxins or tobacco smoke alters protein profiles or functional status. In these cases, surfactant proteins are analyzed using bronchoalveolar lavage, an invasive procedure.

The aim of this study was to collect exhaled breath, which is air transferred from the most peripheral regions of the pulmonary tree, as a condensate (EBC) to determine if components characteristic of the PS, specifically the pulmonary surfactant proteins, were detectable and to establish a profile for their presence in EBC. Using a new amplification system and antibodies to the PS proteins, the researchers established that SPA and SPB were detectable in PS although SPB levels were higher. SPB levels in EBC of 5 subjects were similar, suggesting this protein may be a useful marker and provide some degree of uniformity for assessing EBC in health and disease.

Xuetao Xie