Message from the Senior Executive Associate Dean for Research

It's spring time in Memphis and the fruits of our research labor are blossoming through the many presentations given and papers published.

Spring is the unofficial kick-off of the annual conference season as the weather starts to lighten up. Many of our faculty, staff and students have been present at these professional meetings.

Thus far in the 2014 fiscal year, faculty members have given 29 presentations displaying their research across the country, including several presentations given overseas.

Students have also been engaged in professional presentations. Seven students presented their summer research projects at the 43rd Annual Meeting of the American Association for Dental Research in Charlotte, N.C. Two students also presented at the 102nd Thomas B. Hinman Dental Meeting in Atlanta, G.A.

The College of Dentistry has been equally active in publishing their research. To date, faculty has already published 73 scientific publications in the 2014 fiscal year, two of which are books. In addition, several of our faculty members have been appointed to the editorial board of several of these prestigious journals.

Summer is approaching and the College is gearing up for another summer student program with 30 dental students accepted into the program. We're excited to foster the mentorship in research between students and our dynamic faculty of diverse experience. Of course this would not be possible without the continued support of the UT Dental Alumni.

Clinical Research is in full swing with five industry projects and one federal project currently in progress representing prosthodontics, periodontics, pediatrics and bioscience research.

We are continually proud of the UTCOD research that infiltrates the dental profession and industry. The hard work of faculty, staff, and students has attracted national recognition of our university.
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Dental student researcher, Jeffrey Knittel, presents his poster at the 43rd Annual Meeting of the American Association for Dental Research, with his mentors Margaret Jefferson and Dr. Edwin Thomas.

Keynote speaker, Dr Rade D. Paravina, Professor of Biomaterials at the University of Texas at Houston School of Dentistry, presented his work titled: “Color in Esthetics – The Science Behind Beauty” at the Annual Student Research Day held in February.
Research Faculty and Staff

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Adjunct Professor, Department of Biomedical Engineering, University of Memphis
Adjunct Professor, Department of Biomedical Engineering, Florida International University
Senior Clinical Investigator, The Forsyth Institute, Boston, Massachusetts
Adjunct Professor, Department of Conservative Dentistry and Periodontology, University of Munich

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Director, TMD/Sleep Disorder Clinic

Mustafa Dabbous, M.S., Ph.D.
Professor

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Edward Harris, Ph.D.
Professor

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Professor
Assistant Dean of Institutional Affairs

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Assistant Professor
UT PRESENTATIONS AT THE AADR MEETING IN CHARLOTTE

The 2014 American Association for Dental Research (AADR) 43rd Annual Meeting was held last month in Charlotte (March 19-23), and UT had a strong presence, with 19 poster presentations given by faculty and students. Seven of the posters were student projects, completed during the Student Summer Research Fellowship (funded by the UT Dental Alumni Endowment for Research and the Tennessee Dental Association Foundation), 12 were faculty projects.

Faculty Presentations:

- Babu J, Spencer G, Tipton A. Genistein Mediated Suppression of Monocytic Cells to Secrete Inflammatory Cytokines.
- Costa A, Garcia-Godoy F. Bond Strength of an Etch-and-rinse Adhesive to Different Dentin Substrates.
- Morrow B, Garcia-Godoy F. Flexural strength and fatigue of new active RMGICs.
- Shiloah J, Livada R, Tipton D, Dabbous M. Curcumin Inhibition of Fibroblast HGF/SF-induced Tumor Cell Spreading.
- Simon J, Braxton A, Stamatacos C. Clinical Comparison of Flexible/Stretchable Whitening Strips and Laser Treatment.
- Williams N. Presence of Permanent Molars and Prevalence of Dental Caries.
- Wu J, Garcia-Godoy F. Xylitol and Fluoride Dentifrice Effect on Acid-Etched Enamel: SEM Study

Student Summer Research Presentations:

- Cho S, Tipton D, Dabbous M. Cucurmin inhibition of fibroblast HGF/SF-induced tumor cell spreading.
- Hatten A, Tipton D, Babu J. Cranberry effects on HGF/SF production by human gingival fibroblasts.
- Suliman S, Powell A, Tojan T, Tantbirojn D, Versluis A. In Vitro Analysis of Tooth Enamel after Orthodontic Bracket Debonding.
- Tucker J, Babu J. Influence of Glycated Albumin and Bacterial Lipopolysaccharide Induced Secretion of Inflammatory Cytokines.
Research Spotlight

CHRIS S. IVANOFF, D.D.S. – BIOSCIENCE RESEARCH

Dr. Ivanoff is an experienced clinician, practicing in restorative and general dentistry for over 26 years. He also has extensive experience working in dental research, with his specialty in AC electrokinetics and dielectrophoretic drug transport in dentistry. Since transferring to the Department of Bioscience Research and designating more time to conducting research, Dr. Ivanoff has published many articles in a variety of national journals.

Unlocking the Mysteries of Controlled Drug Delivery in Dentistry

The investigation has been unraveling the secrets to achieving controlled drug delivery to site-specific intraoral targets. Specifically, the studies have explored dielectrophoresis (DEP) as a possible method to transport fluoride and other drugs directly into human tooth enamel. These investigations have proved both qualitatively and quantitatively the effectiveness of DEP to enhance the absorption of fluoride (and other drugs) into human enamel by: (1) achieving greater penetration and (2) achieving greater concentration than diffusion. The studies support DEP as a viable model to deliver other site-specific targeted drugs of variable molecular weight and structure in clinical applications. This technology may potentially revolutionize drug delivery in dentistry. The long term significance of these studies is twofold. Site specific intraoral delivery of antibiotics, analgesics, anti-inflammatory agents, and anesthetics directly into teeth and their supporting structures may provide safer drug delivery in dentistry without having to swallow pills or administer injections. It may significantly reduce further the health risks and side effects of drugs that are delivered systemically making drug delivery in dentistry safer.

The ability to actuate and control fluid in small amounts with high precision and flexibility is critical to safe and efficient drug delivery, but has eluded both dentistry and medicine as well. These investigations showed that several micropumping concepts in microfluidics can successfully be used on the macromolecular scale for intraoral drug delivery. In this case, controlled intraoral fluoride delivery is achieved by a device using (1) dielectrophoresis (DEP) and (2) AC electroosmotic convective vortices to load and transport drugs into teeth by means of a conventional fluoride tray. The flow of drug into teeth is generated directly in the tray by inducing electromechanical effects in the fluid using integrated interdigitated electrodes. The drug driving mechanisms are due to the drug particle-fluid and particle-particle interactions under DEP and AC electroosmosis. This pumping scheme provides a versatile, self-contained intraoral fluidic delivery system that can be used to transport fluoride and other drug molecules of varying molecular weight directly into teeth and their supporting structures.

The studies demonstrated that the coupling of DEP with ACEO can selectively concentrate fluoride particles from fluoride gel excipients and significantly enhance fluoride penetration into both bovine and human tooth enamel. Combined DEP with ACEO drove fluoride 50 μm deep with a single application at concentrations typically seen at 10-20 μm by multiple topical applications, achieved six times the amount of fluoride into the enamel and twice as deep which no current topical fluoride treatment does. Considering the diffusion coefficient of fluoride in enamel has been estimated to be 3.3 x 10-10 cm²/s with an average penetration depth of 8 μm in 4 hours at pH 7.31 the results of this study are significant. To date no in vivo or in vitro study has shown that fluoride can be driven into human enamel beyond 5-20 μm within a clinically relevant treatment time. The study, however, showed that applying DEP in combination with ACEO can drive fluoride to depths of 50-100 μm, at concentrations typically seen at 10-20 μm with conventional applications. DEP/ACE achieved six times the amount of fluoride into the enamel at 10 μm depth, but 30 times deeper in one application, which no topical fluoride treatment currently does. These results are very significant.

It is clear from these studies that combining DEP with ACEO can substantially enhance fluoride uptake beyond values currently achieved by 1-min or 4-min applications of fluoride gel in one application. Other groups have shown that a single application of highly concentrated fluoride can also increase uptake. However, fluoride uptake does not necessarily yield remineralization, a
dynamic process influenced by environmental factors. However, in a study evaluating the microhardness recovery of demineralized enamel after applying 1.23% APF gel with this AC electrokinetic method or diffusion for three minutes to enamel soaked in 10 mM HCl pH for 10 min (conditions mimicking gastric acid reflux), the surface microhardness recovery of enamel with combined DEP and ACEO was 12 times or 1200% greater than APF gel applied topically [29]. In one three minute application of APF gel with DEP+400 Hz, 88.17% microhardness of the demineralized enamel was recovered in comparison to 13.62% microhardness recovery after applying APF gel for three minutes by diffusion. The study not only confirmed the usefulness and efficacy of fluoride in the repair of softened enamel surfaces, but also validated the exploration of combined DEP and ACEO as a useful tool that could potentially repair demineralized lesions deeper than superficial enamel layers achievable by diffusion alone.DEP/ACEO could potentially be a very useful tool for caries prevention. A fluoride reservoir deep within the tooth may provide a long-term source for remineralization. Fluoride penetration with a combined DEP/ACE technique may allow such a reservoir as deep as 100 μm. Considering that current remineralization strategies aim to create an external fluoride or calcium reservoir, a fluoride reservoir deep within the enamel can be drawn from over time to protect the enamel surface. This will need to be investigated in future studies. Communities lacking adequately fluoridated drinking water may benefit from such a remineralization strategy.

**Technology Spotlight**

**Axio Observer .Z1 Inverted Microscope**

**Location**
Bioscience Research Center

**Description**
Carl Zeiss (Jena, Germany) – includes high resolution fluorescence, incubation, and controlled time lapse environmentally experiments

**Applications**
The Z1 can be used to analyze living cells with precise control of factors such as temperature, CO2 and humidity.
The UTHSC College of Dentistry held the 2014 Student Research Day and Table Clinic Competition on February 18 at the Student Alumni Center.

The featured speaker was Dr. Rade D. Paravina, Professor of Biomaterials at the University of Texas at Houston School of Dentistry. His presentation “Color in Esthetics—The Science behind Beauty,” highlighted advances in computer-aided objective evaluation of visual perception of biomaterials and biomimetics.

22 Dental Students and 10 Residents presented results of their studies in 30 posters and table clinics.

Alex Caulder Fitzhugh was selected as winner of the Student Clinician Award for the most outstanding clinical presentation.

In October, Alex will represent UT at the student poster competition of the American Dental Association Annual Session in San Antonio, Texas. His award was sponsored by the Dentsply Corporation and was presented by Dr. Garcia-Godoy, Dr. James C. Ragain Jr., and Keith Harper, Midwest Regional Manager for Dentsply International.

Dr. Yaa Owusu received the Graduate Program Research Award for her presentation, “Isolation and Characterization of Periodontal Ligament Stem Cells of Human Deciduous Teeth.” She was assisted by Dr. Donaldson of the Pediatric Dentistry Department and Drs. Huang, El Ayachi, and Garcia-Godoy of the Bioscience Research Department.

**DENTAL ALUMNI ENDOWMENT for RESEARCH SPRING GRANT DEADLINE**

**What:** UT Dental Alumni Endowment for Research research grant proposals for the Spring 2014 Cycle.

**Deadline:** Friday, April 25th at 5:00 pm CST.

**Submit Electronically:** Dr. Franklin Garcia-Godoy, Chairman of the Ad Hoc Research Review Committee (godoy@uthsc.edu).

This request for proposals is a semi-annual competitive request with deadlines on the last Friday of April and October. Proposals for research funding must follow the guidelines established by the UT Dental Alumni Board. These guidelines are available for download on the Dental Research Website (http://www.uthsc.edu/dentistry/Research/news.php).
The following is a list of current clinical research studies being conducted by UT College of Dentistry faculty. The title, investigators, and study objective are listed for each project.

**A clinical evaluation of NobelProcera™ implant bar overdenture in the mandible or maxilla on 4 NobelProcera™ CC implants**

<table>
<thead>
<tr>
<th>Study Objective</th>
<th>To determine the bone behavior and survival rates of the NobelProcera™ implants, the bar, and the overdenture evaluating its clinical behavior.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Investigator</td>
<td>Dr. Vinay Jain and Dr. Audrey Selecman</td>
</tr>
<tr>
<td>Co-Investigators</td>
<td>Dr. David Cagna, Dr. Pradeep Adatrow</td>
</tr>
</tbody>
</table>

**Multi-center phase 3 trial of minocycline hcl1 mg microspheres for use in subjects with peri-implantitis: clinical and microbiological evaluations.**

<table>
<thead>
<tr>
<th>Study Objective</th>
<th>To demonstrate the ability of Minocycline HCl Microspheres, 1mg to improve peri-implantitis, following mechanical debridement, when compared to debridement alone.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Investigators</td>
<td>Dr. Paul Bland</td>
</tr>
<tr>
<td>Co-Investigators</td>
<td>Dr. Anastasios Karydis, Dr. Rania Livada</td>
</tr>
<tr>
<td>Research Staff</td>
<td>Colette Stewart, Laura Young (Coordinator/Research Associate)</td>
</tr>
</tbody>
</table>

**Influence of Maternal Factors on Caries Development during Early Childhood. A Pilot Study (Ancillary to the CANDLE Study)**

<table>
<thead>
<tr>
<th>Study Objective</th>
<th>The purpose of this study is to investigate the impact of maternal factors on the development of dental cavities among 3-year-old children.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Investigators</td>
<td>Dr. Liang Hong and Dr. Franklin Garcia-Godoy</td>
</tr>
<tr>
<td>Co-Investigators</td>
<td>Dr. Frances Tylavsky (Department of Preventive Medicine – CANDLE Study), Dr. Martha Wells, Dr. Daranee Versluis-Tantbirojn</td>
</tr>
<tr>
<td>Research Staff</td>
<td>Shantel Jeffries (Coordinator/Research Associate)</td>
</tr>
</tbody>
</table>

**Plaque Glycolysis and Saliva Genetics – A Pilot Study**

<table>
<thead>
<tr>
<th>Study Objective</th>
<th>To improve the sensitivity of our laboratory and clinical methods used in plaque analysis and advance the prevention of oral disease including dental caries.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal Investigator</td>
<td>Dr. Franklin Garcia-Godoy</td>
</tr>
<tr>
<td>Co-Investigators</td>
<td>Dr. Yanhui Zhang and Colette Stewart</td>
</tr>
<tr>
<td>Research Staff</td>
<td>Laura Young (Research Coordinator/Research Associate)</td>
</tr>
</tbody>
</table>
The following is a list of publications by College of Dentistry faculty from mid-January 2014 to present, and recent as well as upcoming presentations.

PUBLICATIONS


Lea J, McBride M, Hottel TL. Changes in the Clinical Training of Dental Students at the University of Tennessee College of Dentistry. JSDA (AR State Dental Association), 2014 in press.

PRESENTATIONS


Leslie C. Oropharyngeal airway volume following orthodontic treatment: premolar extraction versus non-extraction. Southern Association of Orthodontists, South Carolina, 2014.

Bolerjack B. A CBCT study of root resorption contrasting premolar-extraction and non-extraction therapies. Southern Association of Orthodontists, South Carolina, 2014.


Ferreira C, Babu J. Sandblasted Acid-etched (SAE) titanium dental implants contaminated with periodontal pathogens and decontamination by chemical reagents used in dentistry. *Academy of Osseointegration Annual Meeting*, Seattle WA. March 5-8, 2014.


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Sigma Xi Excellence in Student Research Award – Robyn Bills, M.S.

Recent graduate of the Department of Clinical Laboratory Sciences Master's of Science in Biomedical Sciences - Laboratory Management program, Robyn Bills, was presented with the Sigma Xi Excellence in Student Research Award upon graduating in December 2013.

The title of her project was “Real-time PCR analysis of P53 and CD82 gene expression in oral cancer cell lines.” This project was completed in the Bioscience Research Lab under the guidance of microbiologist, Dr. Yanhui Zhang and Dr. Franklin Garcia-Godoy.

Sigma Xi is the world’s largest fraternity of professional research scientists and engineers, and boasts over 200 Nobel Laureates.
Awards

Dr. David Tipton was appointed to the Editorial Board for the Journal of Periodontal Research.

Dr. George Huang was appointed to the Editorial Board of the Journal of Dental Research.

Dr. Huang was also appointed to the Editorial Board of the journal Genes & Diseases.

Dr. Vinay Jain was appointed to the Editorial Board of the journal, Austin Journal of Dentistry.

Dr. Barry Owens was appointed to the Journal of Dentistry, Oral Disorders & Therapy.

Dr. Barry Owens was also appointed to the editorial board of the journal the Austin Journal of Dentistry.
The following is a list of current grants/sponsorships held by UT College of Dentistry faculty.

**FEDERAL/FOUNDATION GRANTS**

- **Stem cell-based therapy for regenerative endodontics**
  - PI: George Huang (Bioscience Research)
  - NIH/NIDCR RO1

- **Hinman Student Research Symposium**
  - PI: Franklin Garcia-Godoy, D.D.S., M.S., Ph.D., Ph.D. (Bioscience Research)
  - NIH/NIDCR (R13)

- **Osteonecrosis of the jaw (ONJ) case registry**
  - PI: Cesar Migliorati
  - Amgen

- **Effects of non-thermal plasma treatment on composite restoration and caries prevention**
  - PI: Dr. Liang Hong, D.D.S., M.S., Ph.D. (Pediatric Dentistry)
  - NIH

- **Stem cell-mediated periodontal ligament regeneration for avulsed teeth**
  - PI: Dr. George Huang, (Bioscience Research)
  - American Association of Endodontics

- **Evaluation: NobelProcera implant bar overdenture in the mandible/maxilla on NobelReplace implants**
  - PI: Dr. Vinay Jain and Dr. Audrey Selecman
  - Co-PIs: Dr. David Cagna
  - Nobel Biocare

- **Advanced nursing Education (ANE) Grant**
  - PI: Susan Patton
  - Co-I: Drs Cesar Migliorati, Timothy Hottel, Cassandra Ballard-Holder, Margaret Hartig, and Pamela Connor
  - HRSA

- **Plaque pH analysis project**
  - PI: Dr. Franklin Garcia-Godoy
  - Procter & Gamble

- **Bioscience endodontics research**
  - PI: Dr. AGarcia-Godoy

- **Colgate research**
  - PI: Dr. Franklin Garcia-Godoy
SPONSORSHIPS

- **Fluoride varnish application for treatment of white spot lesion after fixed orthodontic treatment. A pilot study**
  - 3M ES
The UTHSC College of Dentistry was founded in 1878 making it the oldest dental college in the South, and the third oldest public college of dentistry in the United States.

The College contains a 4-year dental program, totaling approximately 320 students. In addition, students in the Postgraduate dental programs and Dental Hygiene are included.

The College is dedicated to providing professional, graduate, and postgraduate education; conducting dental research; and, delivering state-of-the-art patient care and public service.

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