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Foreword

The Dental Faculty would like to position itself to play a key role in the development of new knowledge in dentistry.

The Faculty will leverage on the three major platforms of bioengineering, public health and stem cell research to create impactful knowledge that will assist us in our overall mission to improve oral health through high quality research.

Bioengineering platform covers bio-imaging, biomaterial, tissue engineering, biomechanics, and bio-photonics.

Public Health platform contains epidemiology and oral disease risk assessment and prevention.

Stem Cell platform includes developmental biology, immunology, regenerative medicine, therapy and disease studies.

Associate Professor Cao Tong
Vice Dean (Research)
Vision & Mission

**Faculty Vision**
To be a Dental Institution of International Distinction

**Faculty Mission**
To improve Oral Health through Academic Excellence, High Impact Research and Quality Clinical Service

**Research Mission**
To improve Craniofacial Health and the Delivery of Oral Health Care
## List of Conferred PhD and MSc Students in AY 2009/10

<table>
<thead>
<tr>
<th>Name</th>
<th>Main Supervisor</th>
<th>Degree</th>
<th>Thesis Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chung Sew Meng</td>
<td>A/P Adrian Yap</td>
<td>PhD</td>
<td>Development of Depth-sensing Micro-indentation Strategies for characterization of Dental Composites</td>
</tr>
<tr>
<td>Dr Sum Chee Peng</td>
<td>A/P Anil Kishen</td>
<td>PhD</td>
<td>Interaction of Enterococcus Faecalis to Root Canal Dentine: Role of Direct Action of Chemicals on Dentine Substrate</td>
</tr>
<tr>
<td>Liu Hua</td>
<td>A/P Cao Tong</td>
<td>PhD</td>
<td>Analyzing the Immunobiology of Cultured Mesenchymal Stromal Cells</td>
</tr>
<tr>
<td>Do Dang Vinh</td>
<td>A/P Varawan Sae Lim</td>
<td>MSc</td>
<td>Tooth Replantation</td>
</tr>
<tr>
<td>Li Mingming</td>
<td>A/P Cao Tong</td>
<td>MSc</td>
<td>Human Embryonic Stem Cells as a Cellular Model for Osteogenesis in Implant Testing and Drug on Discovery</td>
</tr>
<tr>
<td>Subakumar Lakshmi</td>
<td>A/P Yeo Jin Fei</td>
<td>MSc</td>
<td>In Vivo/Ex Vivo Osteogenesis of Human Embryonic Stem Cells</td>
</tr>
</tbody>
</table>

## List of Conferred MDS Students in AY 2009/10

### ORAL & MAXILLOFACIAL SURGERY

<table>
<thead>
<tr>
<th>Name</th>
<th>Main Supervisor</th>
<th>Research Title</th>
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</thead>
<tbody>
<tr>
<td>Soong Poh Luon</td>
<td>Dr Lye Kok Weng</td>
<td>Effect of Orthognathic Surgery on Posterior Airway Space (PAS) in Asian Patients</td>
</tr>
<tr>
<td>Teo Bo Tiong Noah</td>
<td>Dr Andrew Tay Ban Guan</td>
<td>Radiographic Signs for Inferior Alveolar Nerve Exposure and Paresthesia Following Third Molar Surgery</td>
</tr>
<tr>
<td>Clement Lye Poh Wah</td>
<td>Dr Poon Choy Yoke</td>
<td>A Randomized Clinical Research to Compare Recovery after Bilateral versus Sequential Unilateral Third Molar Surgery in Terms of Health-Related Ability of Life outcomes: Preliminary Findings from a Pilot Study of the First 17 patients</td>
</tr>
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</table>

### ORTHODONTICS

<table>
<thead>
<tr>
<th>Name</th>
<th>Main Supervisor</th>
<th>Research Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaval Jagdish Patel</td>
<td>Prof Murray Clyde Meikle</td>
<td>The Biochemical, Histological and Molecular Studies of Orthodontic Induced Osteopenia in the Alveolar Bone of a Rat: A Preliminary Study</td>
</tr>
<tr>
<td>Erica Sham Pui Yin</td>
<td>A/P Kelvin Foong Weng Chiong</td>
<td>Human Masticatory Muscle Dimensions and the Upper Airway - A Morphological Study</td>
</tr>
<tr>
<td>Neo Bijuan</td>
<td>A/P Kelvin Foong Weng Chiong</td>
<td>Accuracy of the Dental Cone Beam Computed Tomography in the Avantitative Measurement of Alveolar Bone Support</td>
</tr>
<tr>
<td>Low Gim Hong</td>
<td>A/P Stephen Hsu Chin-Ying</td>
<td>Preventive Effects of Carbon Dioxide Laser Irradiation on Enamel Decalcification around Orthodontic Brackets: An In-Vitro Study</td>
</tr>
<tr>
<td>Tang Panmei</td>
<td>A/P Kelvin Foong Weng Chiong</td>
<td>Suitability of Cone Beam Computed Tomography in Detecting Interproximal Carious Lesions</td>
</tr>
<tr>
<td>Eugene Wee Chun Kheng</td>
<td>A/P Kelvin Foong Weng Chiong</td>
<td>Three-dimensional Intra-arch and Inter-arch Dental Changes Following Orthodontic Treatment with Premolar Extractions</td>
</tr>
</tbody>
</table>

### PERIODONTICS

<table>
<thead>
<tr>
<th>Name</th>
<th>Main Supervisor</th>
<th>Research Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mehta Payal Manoj</td>
<td>A/P Lim Lum Peng</td>
<td>Non-Surgical Periodontal Treatment on Gingival Response and Interleukin 6 in Patients with or without Diabetes</td>
</tr>
<tr>
<td>Ayefa Tariq Sheikh</td>
<td>A/P Lim Lum Peng</td>
<td>Association Between Gingival Recession and Mandibular Symphysis Thickness in Patients who have Undergone Orthodontic Treatment</td>
</tr>
<tr>
<td>Wong Li Beng</td>
<td>A/P Lim Lum Peng</td>
<td>Interleukin-1 in Diabetic and Non-Diabetic Individuals with Varying Degree of Periodontal Disease and The Effect of Initial Periodontal Therapy</td>
</tr>
</tbody>
</table>
Undergraduate Research Opportunities Programme (UROP)

Project Title: Influence of Implant Length/Diameter and Cortical Bone Thickness on Primary Implant Stability

Chua Syynn Tian
Goh Zhiwei Desmond
Heng Li Yun
Hsu Wei Cheng
Ng Kay Eng
Nurul Aizat Bin Zainudin
Pwee Yanxiang Gerald

Supervised by
Dr Ng Chee Hon
A/P Adrian Yap U-Jin

Project Title: Protein expression in Periodontal Ligament Cells Subjected to Cyclic Tensile Strain

Chan Huey Li Deborah
Goh Xian Jun Edwin
Lee Wei Loong Samuel
Leong Kai Lin Irene
Yeo Jing Ting
Yeo Sze Lynn Stephanie
Yong Cuiwei Lydia

Supervised by
Prof Murray C Meikle
A/P Anil Kishen

Project Title: Mechanism of Cariostatic Effects of Yakult

Chua Yee Leng
Guay Shikun Darryl
Kieu Li Chong Edgar
Ma Shiqi
Sin Tong

Supervised by
A/P Stephen Hsu
A/P Lee Yuan Kun

Project Title: Preventive Effects of CO2 Laser on Enamel & Root Demineralization caused by Yakult

Ho Shu Jun Cindi
Quek Hui Qi Sheralyn

Supervised by
A/P Stephen Hsu

Project Title: Cytotoxicity Screening of 3D-printed Porous Titanium Scaffolds using Fibroblasts Derived from Human Embryonic Stem Cells

Ang Chui Noy Michelle
Lai Hiu Fong Sarah
Lim Li Zhen
Quek San Oon Shaun
Tan Shao Yong
Woo Sing Yi Joanne
Yee Ruixiang

Supervised by
A/P Cao Tong
A/P Yeo Jin Fei

Project Title: In Vitro Investigation on the Effect of Endodontic Disinfectants on Bacterial Biofilm

Hee David
Koh Ling Na Helena
Lee Xin Theodora
Ng Qiu Ting
Ong Jien Woon Samuel
Tan Jian Xiong
Tan Shyn Lyn

Supervised by
A/P Anil Kishen

Project Title: An In Vitro Testing of CPP-ACP and TCP with Fluoride in Remineralizing Initial Lesions-A Pilot Study

Neo Huiqi Stephanie
Ruebini Anandarajan
Tay Ee Leen
Teo Xingru Cara
Tey Hwee Shin Valerie
Wang Yuan
Yee Hui Xin Sophia

Supervised by
A/P Ngo Hien Chi

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Tey Hwee Shin Valerie
Wang Yuan
Yee Hui Xin Sophia

Supervised by
A/P Ngo Hien Chi
FACULTY RESEARCH DAY 2009
The purpose of the Undergraduate Research Opportunities Programme (UROP) is to promote and develop research interest in every undergraduate student within the Faculty. Students work in groups under the supervision and guidance of a research mentor. The programme commences in Year 2 and lasts for about two years. A final research report has to be submitted at the end of the programme and selected groups will then present their research findings during the Faculty Research Day.

Faculty Research Day 2009 was held on 30 October 2009 and a total of seven groups presented their findings to a panel of judges comprising of A/P Kelvin Foong Weng Chiong, A/P Lim Lum Peng and Dr Rahul Nair. The results of the competition were as follows:

<table>
<thead>
<tr>
<th>WINNERS (08-03)</th>
<th>1st RUNNER UP (08-07)</th>
<th>2nd RUNNER UP (08-06)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Title</td>
<td>Mechanism of Cariostatic Effects of Yakult</td>
<td>Preventive effects of CO2 laser on enamel &amp; root demineralization caused by Yakult</td>
</tr>
<tr>
<td>Members</td>
<td>Chua Yee Leng, Guay Shikun Darryl, Kieu Li Chong Edgar, Ma Shiqi, Sin Tong</td>
<td>Ho Shu Jun Cindi, Quek Hui Qi Sheralyn</td>
</tr>
<tr>
<td>Supervisor(s)</td>
<td>A/P Stephen Hsu &amp; A/P Lee Yuan Kun</td>
<td>A/P Stephen Hsu</td>
</tr>
</tbody>
</table>

Winning Group

From Left: Dr Rahul Nair, A/P Robert Yee, Ma Shiqi, Guay Shikun Darryl, Sin Tong, Kieu Li Chong Edgar, Chua Yee Leng, A/P Stephen Hsu, A/P Kelvin Foong and A/P Lim Lum Peng

1st Runner Up

From Left: Dr Rahul Nair, A/P Robert Yee, Ho Shu Jun Cindi, Quek Hui Qi Sheralyn, A/P Stephen Hsu, A/P Lim Lum Peng and A/P Kelvin Foong

2nd Runner Up

From Left: Dr Rahul Nair, A/P Robert Yee, Valerie Tey Hwee Shin, Tay Ee Leen, Cara Teo Xingru, Stephanie Neo Huiqi, Wang Yuan, Ruebini Anandarajan, Sophia Yee Hui Xin and A/P Lim Lum Peng, A/P Kelvin Foong, A/P Stephen Hsu and A/P Hien Chi Ngo
Research Highlights

UROP-Faculty Research Day Winning Group
(The winning group represented the Faculty at the IADR SEA Division Travel Award under the Junior Researcher Category in Taipei, Taiwan.)

<table>
<thead>
<tr>
<th>Title of Project</th>
<th>Mechanism of Cariostatic Effects of Yakult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Members</td>
<td>Chua Yee Leng, Guay Shikun Darryl, Kieu Li Chong Edgar, Ma Shiqi and Sin Tong</td>
</tr>
<tr>
<td>Supervisor</td>
<td>A/P Stephen Hsu and A/P Lee Yuan Kun</td>
</tr>
</tbody>
</table>

**Objectives:** To elucidate possible mechanisms and to verify the effects of short term Yakult® consumption on plaque quality, pH recovery, Mutans Streptococci and Lactobacillus counts after a sucrose challenge.

Lactobacilli (LB) counts and salivary buffer capacity were taken for 15 volunteers using Dentocult SM (Strip Mutans®), Dentobuff® Strip, and Dentocult LB® (Orion Diagnostica, Espoo, Finland) test kits respectively. The plaque pH challenge after sucrose challenge (“Stephan curve”) was evaluated at the distal surface of the right upper canine with a palladium-touch pH microelectrode (Orion Research, Inc., Cambridge, MA). In addition, plaque samples retrieved from the same sites were analyzed using RT-PCR techniques. Subjects rinsed daily one bottle of 100ml Yakult® for one week before they returned for follow-up measurements. The difference between baseline and follow-up measurements of the aforementioned variables was analyzed using related parametric and non-parametric statistical tests.

**Results:** The Stephan Curves of participants before and after the intervention period exhibited statistically significant changes. Mean lowest pH increased from 5.02 to 5.22 (p = 0.02), mean recovery time decreased from 9.79min to 6.10min (p<0.001) and AUC decreased from 3424 to 1339 (p = 0.01). Microbiological analysis with RT-PCR revealed the significant decrease of SM counts (p<0.05). The average log value of S.mutans DNA copies decreased from 11.43 to 7.03.

**Conclusion:** This study confirmed that the short term consumption of Yakult® may cause cariostatic ecological shift of oral biofilm through the reduction of SM and acid production.
Caries Risk Assessment for Children in Singapore – Adding Plaque pH as a Risk Indicator

Principal Investigator: A/P Stephen Hsu Chin-Ying
Collaborators: Prof David Koh (SOM, NUS), A/P H Brian Hwarng (Biz, NUS), A/P Teresa Loh Lee Moon Oi (FoD, NUS) and Dr Xu Yunjie (SOC, NUS)
Total Project Value: S$22,808

SUMMARY / ACHIEVEMENTS

Despite the decrease in dental caries rate in developed countries in the last few decades, caries remains the single most common chronic childhood disease with the majority of lesions found in the minority of children, indicating an imperative need to identify high-risk children for early prevention.

The association between plaque acidity and caries has been identified in some studies. As a reflection of multiple microbiological, dietary, salivary factors, and their interactions, plaque pH may serve as a direct and site-specific indicator to help building an accurate caries risk assessment (CRA) model. The objectives of this study are:

• To characterize the plaque pH status of pre-school children in Singapore
• To identify the association between plaque pH and other demographic, behavioral and biological factors
• To determine the association between plaque pH and overall caries profile of children
• To evaluate the predictive value of plaque pH in caries increment
• To incorporate plaque pH in CRA models for a better predictive accuracy compared with those without plaque pH

All the objectives were achieved. Furthermore, the miniaturized pH electrode and probes were successfully applied in one student research project to probe the potential probiotic effects of Yakult on oral biofilm. This project won the NUS Outstanding Undergraduate Research award (OUR) with S$5000 cash award. The student team then participated in the GC Asia-SEAADE Student Prevention Program Competition of the 19th South East Asia Association for Dental Education (SEAADE) ASM in Manila in 2008 and received first place.

UG student, Dr Goh Siew Hor, receiving the award for GC Asia-SEAADE Student Prevention Program Competition
Oral Health Attitudes and Peridontal Disease Risk Profile of Adult Diabetics in Singapore

Principal Investigator: A/P Lim Lum Peng
Collaborators: Dr Fidelia Tay (AH), A/P Thai Ah Chuan (SOM, NUS), Dr Sum Chee Fang (AH), Prof David Koh (COFM, NUS) and Vivian Ng (COFM, NUS)
Total Project Value: S$168,065

SUMMARY / ACHIEVEMENTS

Objectives
- To establish baseline data on periodontal disease profile and oral health attitudes of adult diabetics in Singapore
- Compare periodontal status and blood serum markers in adult diabetics with healthy controls before and following periodontal therapy

Materials & Method
Subjects were recruited from two diabetic centres and those attending treatment in the post-graduate dental clinic, NUS. Oral examination was carried out, treatment provided include oral hygiene and non-surgical periodontal therapy. Blood tests were also taken. Patients were reviewed at three and six months.

Results
Arising from the study, the following findings were obtained:
- At baseline, periodontal disease severity was associated with higher HbA1c, HsCRP and salivary cortisol levels
- Oral health attitudes and behaviour of patients with diabetes are similar with the healthy controls. Periodontal disease did not appear to have significant impact on the oral health quality of life of the participants
- Patients with diabetes presented with higher volatile sulphur compounds (VSC) levels. An improvement in VSC was found following periodontal therapy
- There was a significant improvement of periodontal status following simple periodontal therapy irrespective of glycaemic control. Subjects with poor glycaemic control also showed a significant improvement as measured by HbA1c and cholesterol levels
- There was no consistent difference in HsCRP, TNF alpha, Interleukin1 and Interleukin 6 levels of patients with or without diabetes before and following therapy; some differences could be explained by ethnicity

Conclusion
The findings highlight the importance of oral health promotion in the population to improve periodontal health and reduce bad breath, No definitive conclusion could be drawn on the impact of periodontal therapy in reducing the levels of common inflammatory markers associated with periodontitis

Achievements
Eight MDS research students and one PhD candidate were trained as part of their research training. The study provided some insight into the periodontal disease and inflammatory profile of patients with periodontal disease in the local context. Further studies would be needed to explore the link between periodontal disease and systemic/inflammatory factors.
Load Fatigue Performance of Implant-Ceramic Abutment Combinations
Principal Investigator: A/P Keson Tan Beng Choon
Collaborator: Prof Jack I Nicholls (University of Washington)
Total Project Value: S$91,300 (with Provost Office Funding of S$54,780)

SUMMARY / ACHIEVEMENTS

Ceramic abutments were introduced to meet the demand for ultimate implant aesthetics in the anterior zone. The ceramic abutment-implant combination is an interface involving two dissimilar materials. In addition, conical-abutment connection shave also emerged in newer implant systems with purported platform switching/concave emergence profiles for aesthetic maintenance of the soft tissue cuff. These conical internal connection interfaces have also seen ceramic abutment variants introduced.

Our rotational load fatigue performance protocol elucidated the failure modes of implant-ceramic abutment screw joints and showed clear differences to the conventional metal-to-metal components screw joints. Additional variables were implant diameter (narrow, regular, wide) and interface type (external hex, tricam and press-click internal connection, conical). The study findings reinforce the importance of the clinician weighing the mechanical, biological and aesthetic considerations before selection of any implant system, connection type or abutment material.

In the first part, four systems with their zirconia(Zr) abutments were investigated. three diameters (Narrow, Regular, Wide) for Replace Select (RS) and Branemark (BM) systems (Nobel Biocare (NB)) and two diameters (4.1mm, 5.0mm) of Osseotite-NT (3i.E) and Osseotite-NT Certain (3i.C) systems (Implant Innovations (3i)) constituted 10 implant-ceramic abutment test-groups. Implant fractures were recorded for NB RS narrow and regular diameter groups (6 out of 15 specimens). Damage of implant platform was observed predominantly in failed specimens of NB BN system. Abutment screw fractures were recorded for Goldtite screws (6 of 20 3i specimens), Torqtite screws (2 of 20 NB specimens) and titanium screws (4 of 10 specimens of NB narrow platform). Abutment fractures were observed in narrow diameter...
groups (4 of 10) and regular diameter groups (7 of 10) of NB systems. Abutment fractures were also observed in the 4.1 mm diameter groups of 3i systems (5 of 10). There were significant differences between diameters and between the 10 test-groups. Zr abutments failed in more diverse modes compared to previously reported failures of metal abutments. Zr abutment fracture was found to be a significant risk factor in reducing clinical lifespan.

The second sub-study investigated three conical-abutment systems (Dentsply/Friadent Ankylos (AK), Keystone Primaconnex(PC) and Straumann (ST) Bone-Level) with their corresponding titanium(Ti) and Zr abutments. The AK Ti group had 4 abutment fractures (80%) at a level 0.5mm below the platform with concurrent screw fracture (CSF). AK Zr group had five abutment fractures (100%) 0.5mm below the platform level with CSF. PC Ti group had four samples with screw fracture and 1 sample with implant neck fracture and CSF. PC Zr group had five abutment fractures (100%) just below the screw-head seat. ST Ti group had 5 abutment fractures (100%) just above the internal screw thread. ST Zr group had no failures in four out of five samples and 1 failure (20%) just below the screw-head. Fractographic analysis characterized the failure modes. The ST group was significantly different from the AK or PC groups. For Ti abutments alone, there was no difference between systems but for Zr abutments, the ST group was significantly different from the AK and PC groups. Ti conical abutments had poorer load-fatigue performance compared with earlier studies of Ti external-hexagon connections. Zr conical-abutment load-fatigue performance varied and seemed to be system dependant. Many of the failures in both the Ti and Zr conical abutments fractured within the implant and retrieval will pose a significant clinical challenge.
Role of Brain Lysophospholipids in Pain
Principal Investigator: A/P Yeo Jin Fei
Co-Investigator: A/P Ong Wei Yi (SOM, NUS)
Total Project Value: S$200,000

SUMMARY / ACHIEVEMENTS

Phospholipases A2 (PLA2) cleave sn-2 ester bond in membrane phospholipids to release free fatty acids and lysophospholipids. Mice receiving intracerebroventricular injection of an inhibitor to sPLA2, 12-episcalaradial, exhibited significantly decreased responses to von Frey hair stimulation after facial carrageenan injection compared to vehicle injected mice. Lipidomic analysis of the lower medulla of facial carrageenan-injected rats also showed a significant decrease in phospholipids including phosphatidylethanolamine (PE) and phosphatidylcholine (PC), and significant increase in lysophospholipids species such as lysophosphatidylethanolamine (LPE), lysophosphatidylserine (LPS) and lysophosphatidylinositol (LPI) compared to the controls, indicating an increased PLA2 activity after orofacial pain induced by carrageenan-injection. Quantitative RT-PCR analysis showed high expression of sPLA2-III, sPLA2-XIIA, cPLA2 and iPLA2 mRNA in the upper medulla. Among these isoforms, sPLA2-III showed the highest expression in the lower medulla and its expression was further increased significantly in the carrageenan-injected rats, suggesting the role of this isoform in ascending pain pathway. Similarly, Western blot analysis showed high level of sPLA2-III protein expression in both upper and lower medulla and this enzyme was localized by immunohistochemistry to the spinal trigeminal nucleus and the dorsal- and ventral-horns of the spinal cord. Together the results show an important role of CNS PLA2 in nociception.
DISCOVERY AND DEVELOPMENT

The muscles that define the way we chew the food we eat, yawn, and any other movements involving the lower jaw are called the muscles of mastication. As a muscle group may be viewed as a three-dimensional structure lying underneath the facial skin, a multi-disciplinary research conducted in NUS, led by the A/P Kelvin Fooong of the Faculty of Dentistry, and in collaboration with the Faculty of Engineering (A/P Ong Sim Heng), Yong Loo Lin School of Medicine (Dr Goh Poh Sun) and the A*STAR Biomedical Imaging Laboratory (Dr Ng Hsiao Piau and Prof Wiselaw Nowinski), developed techniques to create three-dimensional models of the muscles of mastication (Fig 1) from two-dimensional slices of magnetic resonance images (Fig 2) that are personalised to the individual.

Arising from this research, this team of clinicians and scientists is building on the acquired knowledge to quantitatively model the dimensional changes of the masticatory muscles at various positions of the lower jaw during a chewing cycle. By visualizing the dynamic changes of the masticatory muscles through magnetic resonance imaging, clinicians may have a better understanding of the pathology affecting the masticatory muscles and a valid diagnostic approach to the structural conditions affecting the related temporo-mandibular joints.

In the creation of accurate anatomic models, when enhanced with advanced computer graphics, there is the additional potential for developing an immersive and interactive environment for the teaching of gross anatomy and applications to surgical anatomy involving the muscles of mastication (Fig 3). With an anatomic model of an individual’s muscles of mastication, the potential for the realistic reconstruction of an individual’s face through the science of facial approximation is a real possibility where models of the skin, the underlying muscles and jaw bones are layered accurately together by the computer as they are in real life (Fig 4a and Fig 4b). Facial approximation is timely with applications in surgical reconstruction following severe trauma, as well as in the areas forensic and archaeological facial reconstructions.

This completed research project, entitled “Volumetric modeling of the muscles of mastication in humans from magnetic resonance imaging” has been productive with the publication of eight internationally refereed papers and the presentation of six international conference papers. A PhD scholar from the NGS-A*STAR scholarship programme was trained entirely through this research project.
Low Modulus Metallic Implants through Printing

Principal Investigator: A/P Cao Tong
Collaboration with SIMTech A*STAR: Dr John Yong Ming Shyan (PI)
Total Project Value: S$88,875

SUMMARY / ACHIEVEMENTS

Biocompatibility of novel 3-dimensional printing titanium dental implant with hESCs

FOD, NUS: Mingming LI, Kai LU, Hua LIU, Wei Seong TOH, Xin FU, Jin Fei YEO, Tong CAO (PI)
SIMTech, A*STAR: Florencia Edith WIRIA, Poon Nian UM, Francis GOH Chung Wen, John YONG Ming Shyan (PI)

The team recently managed to develop a porous titanium dental implant using 3-dimensional printing (3DP), a powder-based solid freeform fabrication method. The main input in a 3DP process is 3-dimensional computer drawing. It allows the flexibility of design customization, which is beneficial for implant fabrication as tailoring of implant size and shape helps to ensure the implant would fit nicely for the patient. This study aims to evaluate bio-compatibility of this novel 3DP porous titanium dental implant with human embryonic stem cells (hESCs).

H1 hESCs and human fetal osteoblast cells were seeded onto the 3DP titanium implants independently. After two weeks culture, attached cells were stained by fluorescein diacetate and propidium iodide to assess the cell viability, attachment and migration. The cells seeded in the 3DP titanium implants were cultured in osteogenic medium. Proliferation was assessed by MTS assay along the time course of differentiation (days 7, 14 and 21). Media was collected every other day up to day 20 and secreted alkaline phosphatase was measured by an enzyme-based colorimetric assay. Co-localization of cell-matrix was examined by collagen type-I and fluorescein diacetate staining. When compared with the negative control, the tested 3DP titanium implants have no cytotoxicity as observed in our MTS results. Both H1 hESCs and human fetal osteoblast cells were able to adhere to the 3DP titanium implants and proliferate well. The cells were able to normally produce collagen type I and alkaline phosphatase in the 3DP titanium implants. Based on in vitro tests, both qualitative and quantitative results suggest that this novel 3DP porous titanium dental implant is highly biocompatible.

H9 VIABILITY AND COLLAGEN-I DEPOSITION

Without Gel, D21

<table>
<thead>
<tr>
<th>FDA</th>
<th>Collagen-1</th>
</tr>
</thead>
</table>

With Gel, D21
Faculty of Dentistry

Project Title: MiRNA Changes in the Frontal Cortex During Orofacial Pain
Principal Investigator: A/P Yeo Jin Fei
Co-Investigator: A/P Ong Wei Yi (SOM, NUS)
Total Project Value: S$60,000

Project Title: The Impact of Oral Health on the Daily Performance of Institutionalised Elderly Singaporeans – a Pilot Study
Principal Investigator: A/P Robert Yee Ting Fai
Co-Investigator: Dr Rahul Nair
Total Project Value: S$172,045

Project Title: Minimally-Invasive Management of Infected Dentine using High-Intensity Focus Ultrasound
Principal Investigator: A/P Jennifer Neo Chew Lian
Co-Investigator: Prof Khoo Soo Cheong (FOE, NUS)
Collaborators: Dr Siew-Wan Ohl (A*STAR) and Dr Evert Klasaboer (A*STAR)
Total Project Value: S$84,905

Project Title: Evaluation of Caries Risk Assessment Models Among Individuals Undergoing Multi-bracket Therapy (Fixed Orthodontic Appliance)
Principal Investigator: Dr Rahul Nair
Co-Investigator: A/P Stephen Hsu Chin-Ying
Collaborators: A/P Robert Yee Ting Fai and Dr Li Xiaobing
Total Project Value: S$70,372

Project Title: Identifying Risk of Exacerbation of Asymptomatic Persistent Endodontic Lesions and Building a Risk Assessment Model for Evidence-Based Management of Asymptomatic Persistent Endodontic Lesions
Principal Investigator: Dr Victoria Yu Soo Hoon
Co-Investigator: A/P Robert Yee Ting Fai
Total Project Value: S$104,102

Project Title: Synergetic Biomolecules Delivery to Promote Diabetic Dentoalveolar Regeneration
Principal Investigator: Dr Chang Po-Chun
Collaborators: Prof Wang Chi Hwa (FOE, NUS) and A/P Lim Lum Peng
Total Project Value: S$179,985
### Research Collaborations in AY 2009/10

<table>
<thead>
<tr>
<th>COLLABORATING ORGANISATIONS</th>
<th>YEAR</th>
<th>DEPARTMENT</th>
<th>REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNIVERSITIES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvard University, USA</td>
<td>2004-2010</td>
<td>Oral &amp; Maxillofacial Surgery</td>
<td>International</td>
</tr>
<tr>
<td>Shanghai Jiatong University, PRC</td>
<td>2006-2010</td>
<td>Oral &amp; Maxillofacial Surgery</td>
<td>International</td>
</tr>
<tr>
<td>Massachusetts General Hospital, Harvard University, USA</td>
<td>2007-2009</td>
<td>Restorative Dentistry</td>
<td>International</td>
</tr>
<tr>
<td>Peking University, PRC</td>
<td>2007-2010</td>
<td>Oral &amp; Maxillofacial Surgery</td>
<td>International</td>
</tr>
<tr>
<td>University of Otago, New Zealand</td>
<td>2009</td>
<td>Restorative Dentistry</td>
<td>International</td>
</tr>
<tr>
<td>University of Texas Health Science Center - San Antonio, USA</td>
<td>2007-2009</td>
<td>Restorative Dentistry</td>
<td>International</td>
</tr>
<tr>
<td>University of Wisconsin Madison, USA</td>
<td>2003-2010</td>
<td>Oral &amp; Maxillofacial Surgery</td>
<td>International</td>
</tr>
<tr>
<td>Zhejiang University, PRC</td>
<td>2005-2010</td>
<td>Oral &amp; Maxillofacial Surgery</td>
<td>International</td>
</tr>
<tr>
<td>University of Iowa, USA</td>
<td>2010-</td>
<td>Oral &amp; Maxillofacial Surgery</td>
<td>International</td>
</tr>
<tr>
<td><strong>RESEARCH INSTITUTES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tissue Modulation Laboratory</td>
<td>2007-2009</td>
<td>Preventive Dentistry</td>
<td>Local</td>
</tr>
</tbody>
</table>
## Research Awards and Prizes Awarded in AY 2009/10

<table>
<thead>
<tr>
<th>Awardees</th>
<th>Award</th>
<th>International/Local/Regional/National</th>
<th>Year Awarded</th>
<th>Awarding Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/P Cao Tong</td>
<td>Singapore Stem Cell Consortium Grant Award</td>
<td>National</td>
<td>2009</td>
<td>Singapore Stem Cell Consortium, A*STAR</td>
</tr>
<tr>
<td>A/P Keson Tan Beng Choon</td>
<td>William R. Laney Award</td>
<td>International</td>
<td>2010</td>
<td>The Academy of Osseointegration (US Based)</td>
</tr>
</tbody>
</table>

## List of Editorial Board Memberships in AY 2009/10

<table>
<thead>
<tr>
<th>Name</th>
<th>Name of Journal / Book Series</th>
<th>Position Held</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/P Cao Tong</td>
<td>World Journal of Stem Cells</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td></td>
<td>Stem Cell Studies</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td></td>
<td>Chinese Journal of Dental Research</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td>A/P Keng Siong Beng</td>
<td>Singapore Dental Journal</td>
<td>Editorial Reviewer</td>
</tr>
<tr>
<td>A/P Lim Lum Peng</td>
<td>Oral Health &amp; Preventive Dentistry</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td>A/P Loh Hong Sai</td>
<td>Saudi Dental Journal</td>
<td>Reviewer</td>
</tr>
<tr>
<td>A/P Jennifer Neo Chiew Lian</td>
<td>Journal of Dentistry</td>
<td>Editorial Board</td>
</tr>
<tr>
<td></td>
<td>Operative Dentistry</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td>A/P Keson Tan Beng Choon</td>
<td>Journal of Oral Rehabilitation</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td></td>
<td>Singapore Dental Journal</td>
<td>Editorial Reviewer</td>
</tr>
<tr>
<td>A/P Yeo Jin Fei</td>
<td>Singapore Dental Journal</td>
<td>Editorial Reviewer</td>
</tr>
<tr>
<td>Prof Loh Hong Sai</td>
<td>Saudi Dental Journal</td>
<td>Reviewer</td>
</tr>
<tr>
<td>Prof Murray Meikle</td>
<td>Royal College of Surgeons, Edinburgh. Journal</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td></td>
<td>American Journal of Applied Sciences</td>
<td>Editorial Board Member</td>
</tr>
<tr>
<td>Dr Chang Po-Chun</td>
<td>Journal of Dental Research</td>
<td>Reviewer</td>
</tr>
<tr>
<td></td>
<td>Journal of Periodontology</td>
<td>Reviewer</td>
</tr>
<tr>
<td></td>
<td>PLoS ONE</td>
<td>Reviewer</td>
</tr>
<tr>
<td></td>
<td>Journal of Biomechanics</td>
<td>Reviewer</td>
</tr>
<tr>
<td>Dr Clarisse Ng Chai Hoon</td>
<td>Journal of Prosthodontics</td>
<td>Editorial Review Board</td>
</tr>
<tr>
<td>Dr Uy Joanne Ngo</td>
<td>Singapore Dental Journal</td>
<td>Editorial Reviewer</td>
</tr>
</tbody>
</table>
Enrolment of Research Students

New and On-going Research Projects

Research Funding
Research Publications

Conference Papers
Research Internships

The Faculty of Dentistry has hosted students from various schools, both locally and internationally as research interns. These schools include Junior Colleges, Polytechnics, and overseas Universities. The duration of the internship varies from a few months to about a year. The internship can either be full-time or part-time. These students receive guidance and supervision from academic staff of the Faculty.

This year, interns from Hwa Chong Junior College (Ang Qianbo Joseph, Lee Jian Xing Clement and Sng Jie Han Timothy) guided by Associate Professor Stephen Hsu participated in Singapore Science and Engineer Fair 2010 (SSEF). The project, entitled “Potential of Barnacle Cement in Dentistry”, received one of the 15 gold awards. They were selected to join the International Science and Engineering Fair (ISEF) 2010 and won the Best Group Award. Their achievements did not stop there as the team participated in Singapore Chemical Science Fair 2010 and won the Platinum Award (first prize).

“Doing research for the past year has taught me a lot about values in life and gave me a new perspective towards research. Having understood how research is not just an activity to produce results, but good training for both the mind and spirit, I have found doing research a delightful activity….All in all, the process of research was inspirational and I have gained much beyond what I could have learnt in a classroom setting. Because of the important lessons I have learnt from research, I feel more ready to take on future challenges and give my best in overcoming them, with a spirit that refuses to give up even when faced with the most impossible boulders”
- Lee Jian Xing Clement
“On hindsight, I felt that Prof Hsu’s intention was to put our group through the process of actively and freely searching for a research topic of our choice. In addition, the 1-month of brain-storming also trained our perseverance and teamwork where our group had to work together by searching for relevant research areas and share our findings…. Finally, our group completed our research paper with the help of Prof Hsu and Dr Gary’s encouragement albeit the numerous less than desired results. Prof Hsu then reiterated the greater importance of the process of research, whereby the research team might have unknowingly acquired non-visible skills, such as innovative and thinking ability, determination in the face of insurmountable difficulties and teamwork. Indeed, the outcome might not necessarily be something that we have desired or expected. Still, the very process of working together on an unusual but interesting multi-disciplinary projects (where fields such as dentistry, marine biology, biochemistry, material science are concerned) is the most memorable part of our journey from which we derived the greatest intellectual stimulation and satisfaction.” - Sng Jie Han Timothy

“Many of the skills that we picked up on this journey of research is also not just confined to the lab, but can be applied in our everyday lives.……through this project, though we were faced with numerous challenges and obstacles, I believe that in the process of overcoming them, what we have benefitted is more of the intangible as we developed our skills, thinking and character. Indeed, the whole journey on this research project has truly been a wonderful, enriching and inspiring learning experience that has impacted me greatly and I believe, is one that has shaped my thinking, values and goals for the future” - Ang Qianbo Joseph