Faculty of Dentistry
The University of Hong Kong

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Research Synopses

Infection and Immunity

Microbes are involved in many common oral diseases in humans, such as caries (tooth decay), periodontal (gum) diseases, and fungal infections. Recent studies have increasingly shown that these oral infections may be implicated in some diseases or disorders affecting the rest of the body. The **Infection and Immunity Research Group** of the HKU Faculty of Dentistry aims to study such topics in a comprehensive manner by using biomedical, clinical, and translational approaches. Below is a selection of summaries of research findings published by the Infection and Immunity Research Group, with online links to abstracts or full papers in *Medline*.

***Dr Rory Watt**, rmwatt@hku.hk, is the convenor of the Infection and Immunity Research Group at the HKU Faculty of Dentistry. A list of the group's members can be found at: http://facdent.hku.hk/discovery/group_infection.html*

*Kang K, Wong KS, Fong WP, **Tsang PWK.***

***Metergoline-induced cell death in* Candida krusei.**

Fungal Biol 2011;115:302-9. http://www.ncbi.nlm.nih.gov/pubmed/21354537

■ Metergoline, a serotonin receptor antagonist prescribed as an anti-migraine drug, was successfully used in laboratory tests to kill a fungus that is increasingly causing disease but is resistant to many conventional antifungal drugs. Twelve hours of exposure to low doses of metergoline triggered apoptosis (a type of programmed cell death, or 'cell suicide') as well as necrosis (bursting), whereas high doses killed cells mainly by necrosis.

*Li X, Tse HF, Yiu KH, Jia N, Chen H, Li LSW, **Jin LJ.***

Increased levels of circulating endothelial progenitor cells in subjects with moderate to severe chronic periodontitis.

J Clin Periodontol 2009;36:933-9. http://www.ncbi.nlm.nih.gov/pubmed/19799717

*Li X, Tse HF, Yiu KH, Li LSW, **Jin LJ**.*

Effect of periodontal treatment on circulating CD34+ cells and peripheral vascular endothelial function: a randomized controlled trial.

J Clin Periodontol 2011;38:148-56. http://www.ncbi.nlm.nih.gov/pubmed/21133981

*Lu Q, **Jin LJ**.*

Human gingiva is another site of C-reactive protein formation.

J Clin Periodontol 2010;37:789-96. http://www.ncbi.nlm.nih.gov/pubmed/20666874

■ These clinical studies showed for the first time (1) the association between increased levels of endothelial progenitor cells in the blood circulation and

chronic periodontitis (an advanced gum disease); (2) the significant effect of periodontal (gum) treatment on the level of these cells in the circulation; and (3) the production of C-reactive protein in the human gum. The findings provide insight into molecular mechanisms that may account for the link between gum infections and heart and blood vessel diseases.

Chen WY, Ho JWS, Huang JD, Watt RM.

***Functional characterization of an alkaline exonuclease and single strand annealing protein from the SXT genetic element of* Vibrio cholerae.**

BMC Mol Biol 2011;12:16. http://www.ncbi.nlm.nih.gov/pubmed/21501469

■ This study characterised the functions of two proteins that help the virus-like SXT particle establish itself within cells of *Vibrio cholerae*—the bacterium that causes cholera. The information will contribute to the design of bacterial genetic engineering systems based on recombining genetic material ('recombineering').

Lui J, Corbet EF, Jin L.

Combined photodynamic and low-level laser therapies as an adjunct to nonsurgical treatment of chronic periodontitis.

J Periodont Res 2011;46:89-96 . http://www.ncbi.nlm.nih.gov/pubmed/20860592

■ This clinical trial demonstrated that using special laser therapies after professional cleaning (scaling and root debridement) may be beneficial "on a short-term basis" to treat chronic periodontitis (an advanced gum disease). Compared with only cleaning, the additional use of low-energy diode laser, known to promote gum healing, and application of a laser-activated disinfectant, known as 'photodynamic therapy', led to greater improvements in gum health after 1 month. However, this advantage disappeared by 3 months.

Bandara HMHN, Yau JYY, Watt RM, Samaranayake LP.

Pseudomonas aeruginosa *inhibits in-vitro* Candida *biofilm development.*

BMC Microbiol 2010;10:125. http://www.ncbi.nlm.nih.gov/pubmed/20416106

■ The fungus *Candida* and the bacterium *Pseudomonas aeruginosa* can both attach to medical devices and cause infection. This laboratory study showed that when the two organisms were cultured together, they reduced each other's growth and ability to attach to a plastic surface as a biofilm, suggesting mutual inhibitory effects.

Chai L, Song YQ, Zee KY, Leung WK.

SNPs of Fc-gamma receptor genes and chronic periodontitis.

J Dent Res 2010;89:705-10. http://www.ncbi.nlm.nih.gov/pubmed/20439936

■ This clinical study identified novel genetic variations associated with the occurrence of chronic periodontitis (an advanced gum disease) within human populations.

Kang K, Fong WP, ***Tsang PWK.***

Novel antifungal activity of purpurin against* Candida *species in vitro.

*Med Mycology 2010;48:904-11.*http://www.ncbi.nlm.nih.gov/pubmed/20392152

■ Purpurin, a cloth dye, was found to have antifungal activity against several *Candida* fungi in the laboratory. The compound worked by triggering a type of programmed cell death (apoptosis).

Wong KS, Fong WP, ***Tsang PWK.***

A single Phe54Tyr substitution improves the catalytic activity and thermostability of* Trigonopsis variabilis *D-amino acid oxidase.

N Biotechnol 2010;27:78-84. http://www.ncbi.nlm.nih.gov/pubmed/19909828

■ By mutating a single point in an enzyme from a type of yeast, this research team made the enzyme more heat-stable than the naturally occurring version. The mutation also increased the rate of enzyme-catalysed conversion of the antibiotic cephalosporin C into the product glutaryl-7-aminocephalosporanic acid—a chemical reaction that is key in both the industrial manufacture of certain antibiotics and the search for new antibiotics.

Fan MHM, Wong KL, Wu S, ***Leung WK****, Yam WC, Wong TM.*

Preconditioning with* Porphyromonas gingivalis *lipopolysaccharide may confer cardioprotection and improve recovery of the electrically induced calcium transient during ischemia and reperfusion.

J Periodont Res 2010;45:100-8. http://www.ncbi.nlm.nih.gov/pubmed/19602110

■ Lipopolysaccharide (LPS) toxin from *Porphyromonas gingivalis*—a bacterium associated with gum disease and heart and blood vessel diseases in humans—had two, opposite effects on rat hearts. High and low doses of purified LPS were injected into rats, in the space between the organs in the abdomen. On the next day, heart attacks were simulated by temporary starvation of isolated hearts. Pretreatment with a low dose of LPS seemed to be protective, but pretreatment with a high dose amplified heart damage.

Seneviratne CJ, *Wang Y,* ***Jin L****, Abiko Y,* ***Samaranayake LP.***

Proteomics of drug resistance in* Candida glabrata *biofilms.

*Proteomics 2010;10:1444-54.*http://www.ncbi.nlm.nih.gov/pubmed/20127690

Samaranayake YH, *Yau JY, Thein ZM, Jayatilake JA, Yeung KW,* ***Samaranayake LP.***

***The post-antifungal effect (PAFE) of amphotericin B, nystatin, ketoconazole and 5-fluorocytosine and its impact on the colonization traits of* Candida glabrata.**

Med Mycology 2010;48:725-34. http://www.ncbi.nlm.nih.gov/pubmed/20092419

■ Using different laboratory tests, these researchers discovered a novel mechanism that allows fungus cells that grow in layers attached to surfaces (biofilms) to have very high levels of resistance against clinically used antifungal drugs. The findings will pave the way to develop new strategies against fungal infections, which are killing many hospitalised patients in Hong Kong and other parts of the world.

Perera RA, ***Samaranayake LP, Tsang CS.***

Shedding dynamics of Epstein-Barr virus: A type 1 carcinogen.

Arch Oral Biol 2010;55:639-47. http://www.ncbi.nlm.nih.gov/pubmed/20627195

■ This review identified key factors in the process by which the cancer-causing Epstein-Barr virus is released into the saliva and other bodily fluids of infected individuals.

So CW, ***Tsang PWK****, Lo PC,* ***Seneviratne CJ****,* ***Samaranayake LP****.*

Photodynamic activation of* Candida albicans *by BAM-SiPc.

Mycoses 2009;53:215-20. http://www.ncbi.nlm.nih.gov/pubmed/19298354

■ Using a specially designed chemical compound, these researchers were able to kill *Candida albicans* fungus with light. They first allowed a new light-sensitive chemical (a bisamino-phthalocyanine) to enter fungus cells and then shone a medical laser of 675-nm wavelength to activate the chemical. This step generated toxic oxygen-related molecules (reactive oxygen species) that killed the fungus cells. The amount of cell death depended on the amount of chemical used, but neither the laser nor the chemical alone had any effect.

Edited by Dr Trevor Lane, Knowledge Exchange Unit, HKU Faculty of Dentistry. Although every care has been taken to ensure the accuracy of the contents of this news release, they do not necessarily reflect the official policies of the Faculty or University and are intended for informational or educational use only; the copyright owner accepts no responsibility for errors or omissions.

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