Molecular Microbiology (Clinical Meta-genomics)

Principal Investigator
Professor Sunny Wong

Team
Thomas Kwong, Xiansong Wang, Avis Shiu, Rudin Dai, Tai-cheong Chow

Research Progress Summary

The mucosal surfaces of the gut are colonised by large numbers of microorganisms that contribute to human health and diseases. These micro-organisms, collectively surpassing the number of the host cells, provide an extensive biochemical repertoire to carry out important metabolic, developmental and immunological functions. Increasing evidence suggests that the gut microbiota also take part in the pathogenesis of common diseases, including obesity, atherosclerosis, inflammatory bowel diseases, colorectal cancer and Clostridium difficile infection. Disruption of the microbial ecology and alternations in bacterial abundance are frequently observed. Such detailed observations are now possible with the advent of sequencing technology and bioinformatic tools, which have enabled them to describe the microbial environment at an unprecedented depth. Together with the functional studies in human and animal models, metagenomics is unfolding the secluded mechanisms of many common diseases.

Relative abundance of the microbial marker Fn in colorectal cancer, advanced adenoma and controls.

Diagnostic performance with the AUC, sensitivities and specificities of fecal immunochemical test, individual microbial markers and their combinations for the diagnosis of colorectal cancer.

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In this regards, the team works to investigate the gut microbiota and host-microbe interaction in various digestive diseases. For colorectal cancer, the team has continued the previous metagenomic studies to newly identify a *Fusobacterium* microbial marker for the detection of advanced colorectal neoplasia (Wong et al., Gut 2016). In the study, they have consistently observed a higher *Fusobacterium* abundance in patients with colorectal cancer and advanced neoplasia, whereas addition of the marker can significantly improve performance of the fecal immunochemical test in detecting the lesions. The marker, when combined with the immunochemical test, has showed superior sensitivity (92.3% vs 73.1%, p<0.001) and area under curve (0.95 vs 0.86, p<0.001) than stand-alone immunochemical test in detecting colorectal cancer. This approach takes them one step further towards a non-invasive and more accurate diagnosis of advanced colorectal neoplasia.

Apart from colorectal cancer, the team has also published on other digestive diseases including *C. difficile* infection and inflammatory bowel diseases. Given the increasing number of *C. difficile* cases as a major gastrointestinal nosocomial infection, they have carried out a microbiological study and identified ribotype 002 as a major pathogenic subtype in Hong Kong (Wong et al., J Infect 2016). This work has led to a few on-going projects on this bacterium, including a successful grant approved by the Research Grant Council (RGC). Furthermore, the team has worked on the microbe-based testing of latent tuberculosis in patients with inflammatory bowel (Wong et al., Inflamm Bowel Dis 2014) and other autoimmune diseases (Wong et al., Thorax 2016). These works are only possible with the enormous support from the Li Ka Shing Institute of Health Sciences.

The diagnostic performance of fecal immunochemical test, marker Fn and their combined test indicated by the ROC analysis.

The colorectal cancer samples detected by fecal immunochemical test and detected by marker Fn (blue), and missed by both tests (yellow).

Recognitions

Awards and Fellowships

<table>
<thead>
<tr>
<th>Member’s Full Name</th>
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<tbody>
<tr>
<td>Sunny Wong</td>
<td>Fellowship of the Hong Kong Academy of Medicine</td>
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<td>Sunny Wong</td>
<td>Fellowship of the Hong Kong College of Physicians</td>
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<tr>
<td>Sunny Wong</td>
<td>Distinguished Research Paper Award for Young Investigators, Hong Kong College of Physicians</td>
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<td>Sunny Wong</td>
<td>Exemplary Teachers’ Award, Department of Medicine and Therapeutics</td>
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Grants and Consultancy

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<tr>
<th>Full Name of PI</th>
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<th>End Date (dd/mm/yyyy)</th>
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<tr>
<td>Sunny Wong</td>
<td>Clarifying the Mechanisms of Ribotype 002 Virulence in <em>Clostridium difficile</em> Infection</td>
<td>Research Grant Council – General Research Fund / Early Career Scheme</td>
<td>01/07/2016</td>
<td>31/12/2020</td>
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<td>Sunny Wong</td>
<td>CRISPR-Cas9 Mediated Gene Splicing as a Novel Therapy for <em>Clostridium difficile</em> Infection</td>
<td>Shenzhen Science and Technology Innovation Commission</td>
<td>01/03/2016</td>
<td>31/12/2017</td>
<td>239,210</td>
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<tr>
<td>Sunny Wong</td>
<td>A Metagenomic Study on Patients with Premalignant Neoplastic Polyp</td>
<td>Croucher Foundation</td>
<td>30/12/2013</td>
<td>29/12/2017</td>
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Publications

A. Journal Papers


B. Book Chapters


C. Conference Papers

1. Wong SH, Tang W, Wu JC, Ng SC. Clostridium difficile infections in inflammatory bowel disease patients is associated with increased use of immunosuppressant and higher rates of colectomy: results from a population-based cohort. In: Digestive Disease Week; San Diego, USA; 2016 May 21–24.

2. ‘Effect of immunosuppressive therapy on interferon-gamma release assay for latent tuberculosis screening in patients with autoimmune diseases’, Oral Presentation at the Annual Scientific Meeting, Hong Kong College of Physicians.
