FACULTY OF HEALTH SCIENCES

2021 WEEKLY NEWSLETTER

Issue 31 | 2 - 6 August

Publication

1. Liu, D., Zhang, M., Huang, H. H., Feng, Q., Su, C., Mo, A., Wang, J.-W., Qi, Z., **Zhang, X.**, Jiang, L., and Chen, Z. (2021) CoII–ZnII Heterometallic Dinuclear Complex with Enhanced Photocatalytic Activity for Co2-to-Co Conversion in a Water-Containing System. *Acs Sustain Chem Eng* **9** (28), 9273-9281 **[5yr IF = 8.471]**

2. Goh, K. J., Ero, R., Yan, X. F., Park, J. E., Kundukad, B., **Zheng, J.**, Sze, S. K., and Gao, Y. G. (2021) Translational GTPase BipA Is Involved in the Maturation of a Large Subunit of Bacterial Ribosome at Suboptimal Temperature. *Front Microbiol* **12**, 686049 **[5yr IF = 6.32]**

1 Article Sharing

FHS Achieves a Breakthrough in Fungal Biology Research

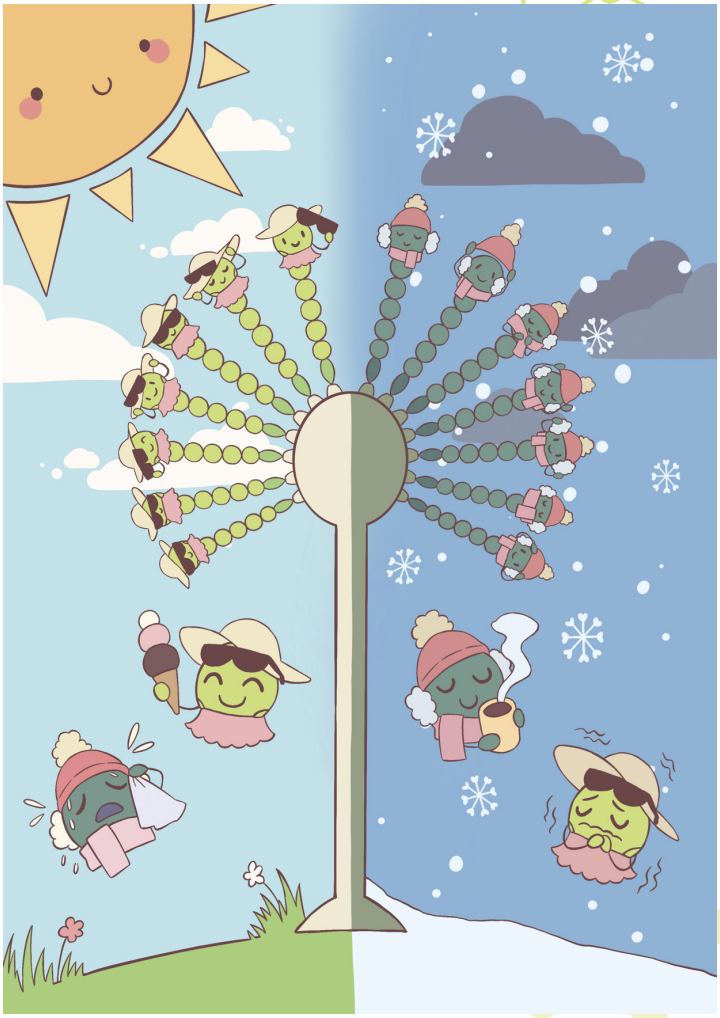
FHS has made a breakthrough in understanding the biology of fungal spores which are the main infectious agent of fungal pathogens that cause deadly infections in humans. Life-threatening fungal infections usually affect immuno-compromised people; however, the recent COVID-19 pandemic has rendered all of us susceptible, as evidenced by the rocketed number of “black fungus” and Aspergillosis infections among COVID-19 patients.

Spores (a.k.a. conidia for filamentous fungi) are the “babies” of fungi and can be found everywhere in our environment. We breathe in several hundred to a thousand fungal spores every day. Spores can survive diverse stresses and environmental conditions and remain dormant for a long time until favourable conditions are encountered. How fungal spores establish dormancy is not clear, although there have been ideas about the process. A team, led by Prof. Chris Koon Ho WONG, in the university’s Faculty of Health Sciences (FHS) has discovered a fascinating phenomenon about how filamentous fungal spores prepare for their future growth, survival and capabilities before entering dormancy. As fungi affect our lives both positively and negatively in many

different ways (e.g., through the agriculture, biotech, food and drug industries as well as causing diseases), the discovery has far-reaching significance to everybody in the world. The work titled “Transcription in fungal conidia before dormancy produces phenotypically variable conidia that maximize survival in different environments” is now published in the August issue of the reputable journal *Nature Microbiology*. The paper is being spotlighted on the cover page of *Nature Microbiology* and is featured by *Faculty Opinions*, ScienceNet, BioArtand and a *Nature Microbiology* News and Views article written by the world-renowned fungal biologist Jean-Paul Latgé from The Institut Pasteur.

Spores have always been portrayed as dormant cells produced by fungi for dispersal and survival. The development of filamentous fungal spores involves an elaborate program mediated by various specialized cell types of the developmental structure conidiophore. Chains of spores bud off from each conidiophore producing thousands of genetically identical cells. Previous evidence suggests that spores are passively packaged with biological materials such as mRNAs and proteins, which are generally believed to be originated from the cells of conidiophores. The exact purposes of the biological materials are not clear.

The work began with a curious question: “Are fungal spores really dormant?”. Fang WANG – a new PhD at that time and the first author of the paper – performed a simple experiment (Chromatin Immuno-precipitation followed by Sequencing against RNA polymerase II) checking whether spores have any transcription activity. To her surprise, the so-called dormant spores have robust transcriptional activities and can elicit transcriptional responses to the environment, which are similar to those seen in actively growing cells. This finding indicates that fungal spores are not dormant even after development has been completed, challenging the common notion about spore dormancy. The unexpected observation then led Fang to a series of carefully planned experiments showing that fungal spores establish dormancy after they are separated from the developmental structure upon dispersal to the environment. More importantly, the team also demonstrated that the spore experience before dispersal (i.e., before dormancy) could influence their growth, survival, virulence and toxin production



A cartoon depicting the main discovery of the work

capabilities later after they break dormancy. The overall work uncovers a fascinating phenomenon that fungal spores are highly proactive in their own development to prepare for their future according to the environmental conditions they experienced before entering dormancy. In other words, “fungal spores are future-proofed” – which is the title of the News and Views article that highlights the overall findings of the work. Taken together, the discovery has “redefined fungal dormancy” – a theme used by Nature Microbiology for the cover page of the latest issue where this work is published. Given the escalating threats of fungal infections in the clinics over the last decade, the understanding of how fungal spores acquire abilities relevant for virulence has important implications towards human health, especially in the current COVID-19 pandemic when everyone is predisposed to fungal infections.

The study was carried out by the PhD student Fang WANG under the supervision of Prof. Chris Koon Ho WONG and with help from other PhD students (Pooja SETHIYA, Shuhui GUO and Ang LI) and members (Dr. Yingying CHEN and Dr. Kaeling TAN) of the Wong lab. Dr. Xiaohui HU and Dr. Kaeling TAN from the Drugs Development Core and Genomics, Bioinformatics and Single Cell Analysis Core of FHS also contributed to the work. The project was supported by the Science and Technology Development Fund, Macao SAR (File no. 0106/2020/A) and UM’s research fund (File no. MYRG2018-00017-FHS and MYRG2019-00099-FHS). The full version of the research and News and Views articles can be viewed at https://rdcu.be/cnlx8 and https://www.nature.com/articles/s41564-021-00946-4, respectively.

2 BCAT Meeting

In the online B-CAT meeting on 4 August, Prof. Zhen YUAN reported the temperature-feedback nanoplatform for the NIR-II penta-modal imaging-guided synergistic photothermal therapy and the CAR-NK immunotherapy of lung cancer.

To visually acquire all-round structural and functional information of non-small cell lung cancer while performing the synergistic targeted photothermal therapy (PTT) and CAR-NK immunotherapy, a theranostic nanoplatform that introduced upconversion nanoparticles (UCNPs) and IR-1048 dye into the lipid-aptamer nanostructrure (UCILA) was constructed. In particular, UCILA exhibited enhanced second near-infrared window (NIR-II) photoacoustic (PA), NIR-II optical coherence tomography (OCT) and NIR-II photothermal imaging (PTI) as well as mico-CT and thermo-sensitive NIR-II up-conversion luminescence (UCL) imaging capability, enabling real-time tracking of metabolic activity of tumor and temperature-feedback NIR-II PTT with favorable biocompatibility for cancer theranostics.

In addition, UCILA as the NIR-II light-medi-

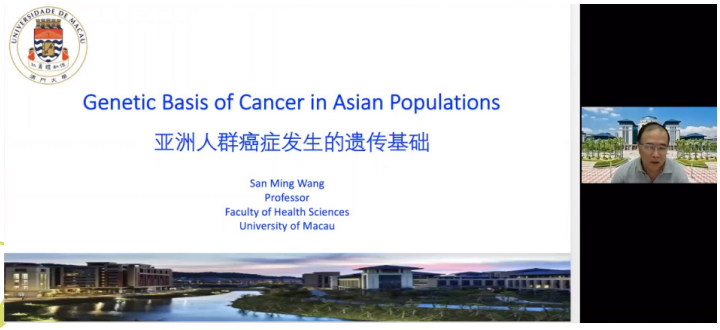
ated and targeting theranostic agents, also demonstrated high efficacy of synergistic targeted NIR-II PTT and targeting CAR-NK immunotherapy. After the temperature-feedback PTT and CAR-NK immunotherapy, the tumors in the living mice were almost ablated without overheat to the circumambient normal tissue and cells. Meanwhile, the synergistic treatment group showed no relapse and no metastasis of lung cancer in other organs.

Prof. Zhen concluded the novelty and significance of his work that: 1) NIR-II theranostics platform was constructed including NIR-II PA, NIR-II OCT, NIR-II thermal imaging and NIR-II PTT; 2) Additional photothermal imaging and NIR-II UCL imaging were carried out to achieve temperature-feedback PTT; 3) Synergistic temperature-feedback targeted PTT and targeting CAR-NK immunotherapy were performed for high efficacy treatment of lung Cancer. Prof. Zhen also claimed that thanks to the complementary guidance of penta-modal imaging, UCILA was demonstrated to be efficient to eliminate the non-small-cell lung carcinoma with minimum side-effects. More importantly, Prof. Yuan's group also developed novel apoptotic body-camouflaged liposome drugs with the active-targeting characteristics for brain intervention of traumatic brain injury. The as-prepared biomimetic drugs cannot only passed the blood-brain barrier (BBB) but also specifically targeted the injury areas to inhibit inflammation. Their pre-clinical results showed the great potential of apoptotic body-camouflaged drugs for future clinical intervention of various brain disorders.

3 Seminar Series

Genetic Basis of Cancer in Asian Population – Prof. San Ming WANG

Prof. San Ming WANG presented "Genetic Basis of Cancer in Asian Population" in the Ministry of Education (MoE) Frontiers Science Center for Precision Oncology (FSCPO) Seminar Series on 3 August.



Prof. Wang claimed that hereditary cancer gene mutation is the most certain carcinogenic cause, contributing to 20% of cancers. Examples are the BRCA (BRCA1, BRCA2) gene mutations lead to breast and ovarian cancer, DNA mismatch repair genes MMR (MLH, MSH, MSH, PMS2) mutations cause colorectal cancer. He suggested that cancer can be prevented through early preventive actions and diagnosis for the mutation carriers not yet developed cancer. Individualized treatment can also be designed for the patients for the mutation carriers developed cancer. Prof. Wang further introduced that cancer gene mutation is highly ethnic-specific and said that while cancer gene mutation test is a routine oncological practice in the Caucasian populations, it is still in its infancy in Asia. There is no cancer gene mutation-based system for cancer preven-

tion for the non-cancer population in Asia, and clinical diagnostic standard in Asian is highly dependent on the mutation data originated from the Caucasian populations. His lab therefore aims to fill this huge gap in human cancer genetics by collecting the mutation data from over 400,000 individuals in mainland China, Macao, Taiwan, Malaysia, Singapore, South Korea, Japan, and India. His laboratory has systematically analyzed the basic features of BRCA and MMR mutations in the Asian populations and found that the mutation spectrum and prevalence of BRCA and MMR mutations and the number of mutation carriers in each population revealed the systematic differences of BRCA and MMR mutations between Asian populations and Caucasian populations. He further reported that he has developed a series of BRCA and MMR mutation databases for each Asian population and his systematic study revealed the genetic basis of cancers caused by BRCA and MMR mutations in the Asian populations, and laid a foundation for advancing cancer prevention and treatment in the Asian populations, including the population in Macao and the Great Bay Area.

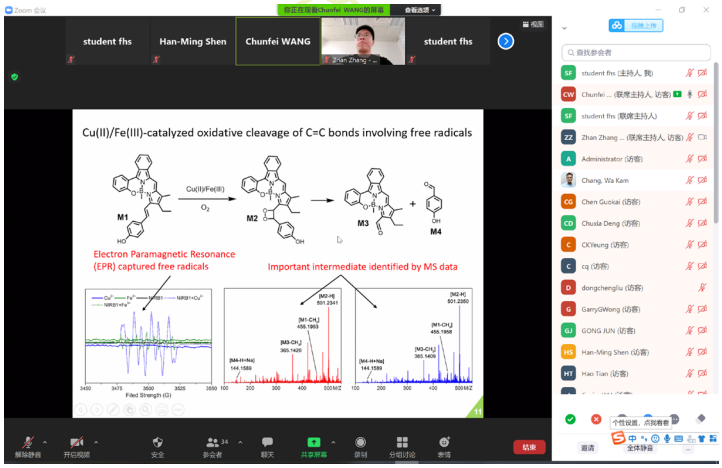
Video content reliving for the seminar series is available on https://fhs.um.edu.mo/en/researchs/research-units/umfscpo/seminar-series/.

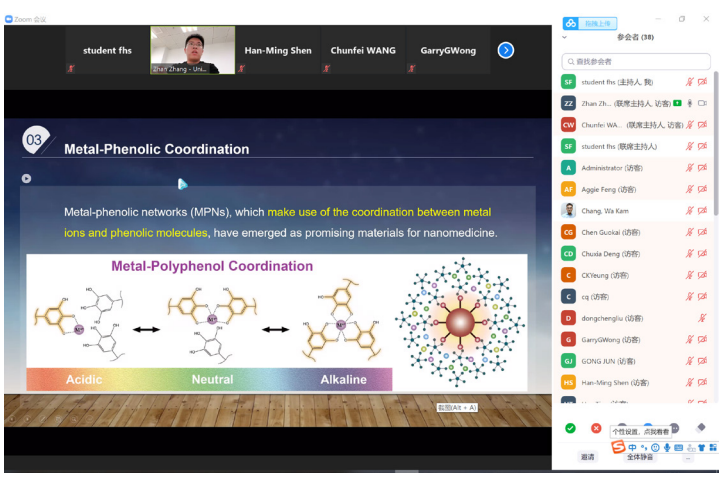
4 FHS Postdoc Student Seminar

Presented by Prof. Xuanjun ZHANG's Group and Prof. Yunlu DAI's Group

On 5 August, Mr. Chunfei WANG of Prof. Xuanjun ZHANG's group and Mr. Zhan ZHANG of Prof. Yunlu DAI's group presented "Abiotic Cleavage of C=C Bonds to Activate Fluorophore for Bioimaging in Living Systems" and "Metal-Phenolic Coordination-Based Nanoplatform for Cancer Therapeutics" respectively.

The next seminar will be held on 19 August, and presented by the group member of Prof. Qi ZHAO.





UPCOMING EVENTS

August		
Mon	**9**	**16** **Oral Defence** Speaker: Wen LI Supervisor: Prof. Yutao XIANG Time: 9:00 Venue: E12-1015 **Oral Defence** Speaker: Yuan YANG Supervisor: Prof. Yutao XIANG Time: 11:00 Venue: E12-1015
Tue	**10**	**17** **Oral Defence** Speaker: Koukou LI Supervisor: Prof. Kathy LUO Time: 10:00 Venue: E12-1015
Wed	**11**	**18** **Oral Defence** Speaker: Liguo DONG Supervisor: Prof. Chris Koon Ho WONG Time: 10:00 Venue: E12-1015 **Oral Defence** Speaker: Lipeng ZHU Supervisor: Prof. Qi ZHAO Time: 14:00 Venue: E12-1015 **BCAT Meeting** Speaker: Prof. Xiaoling XU Time: 17:00-18:00 Venue: ZOOM
Thu	**12**	**19** **FHS Postdoc/ Student Seminar** Session: Cancer research, Drug development Host: Prof. Qi ZHAO Time: 17:00-18:00 Venue: ZOOM
Fri	**13**	**20**
Sat	**14**	**21** **Oral Defence** Speaker: Haibin YANG Supervisor: Prof. Garry WONG Time: 10:00 Venue: E12-1015

For more information or submission of articles to be featured, please contact Ms. Mathilde CHEANG at mathildec@um.edu.mo or 8822 4909.