New Development in Food Technology

Dr. Ka Hing WONG

Executive Director, Food Safety & Technology Research Centre,

The Hong Kong Polytechnic University

FSTRC

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

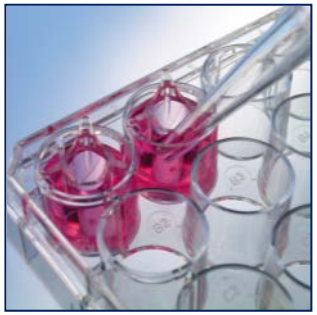
Background

Food Safety Problems




- ✓ Food adulteration
- ✓ Food contaminants (e.g. melamine, malachite green, plasticizer etc.)
- ✓ Outbreak of foodborne pathogens….

Food Technology Needs




- ✓ Rapid & high-throughput methods for detecting harmful substances
- ✓ Advanced processing technology for improving food quality…..

FSTRC

The Hong Kong Polytechnic University 香港理工大學

Food Safety & Technology Research Centre

- Established the 1st university-based Research Centre in HK focusing food safety & technology in 2011
  - secured HK$100 million of research grants obtained from HK & China
  - as International Research & Information Hub; established over 30 collaborations with universities, government agencies & food companies over the world since 2011
- aims to become a world-class food safety & technology authority; offer one-stop services to all stakeholders, hereby safeguarding the public health of our community

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香港理工大學

Research Focus

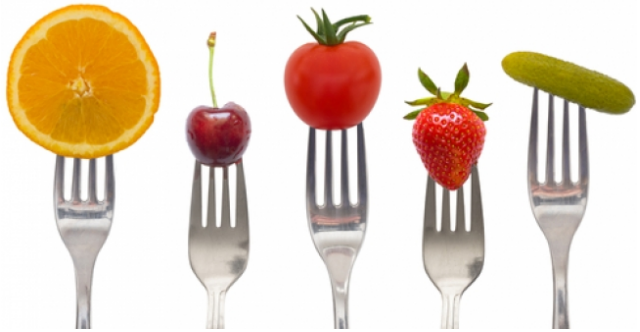
Testing & Certification

Risk Analysis & Toxicology

Novel Technology Development

Functional Food Development

Food Microbiology



Nutrition & Public Health

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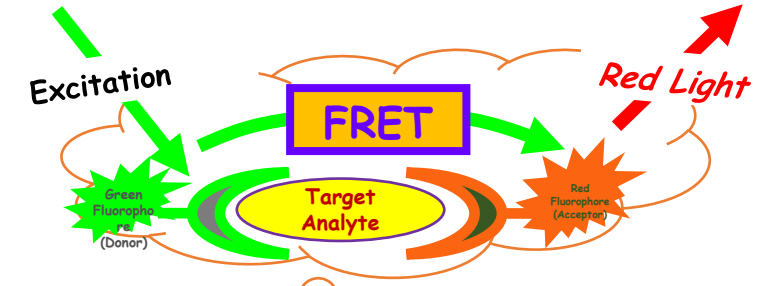
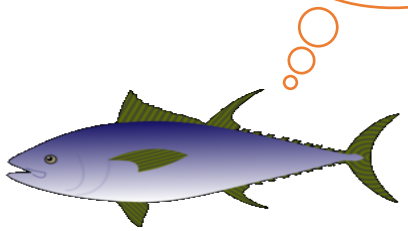
Testing & Certification

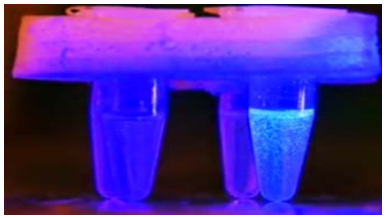
Development of FRET-based rapid detection technique for formaldehyde

PI: Dr. Man-kin Wong

- FRET-based rapid detection technique for formaldehyde
- High specificity and stability; not affected by food color; Relatively low cost
- Funded by 2011年對外科技合作專項-廣州市科技和資訊化局
- *Suitable for on-site food safety testing and front line quality control*
- Collaborated with GDCIQ
- Chinese patent file no.: 201410409453.X







Testing & Certification

Development of a Novel Food Hygiene Standard Certification System for Food Premises

PI: Dr. Ka Hing WONG & Dr. Ka-sing LEUNG

- Officially launched on 28 Sept 2017
- Establish a novel Food Hygiene Standard Certification System (FHSCS) targeting catering industry based on HACCP principles
- Upgrade food hygiene standard of the catering industry (especially SMEs) with minimum requirements for certification
- Funded by ITF-GSP; Catering & certification Industry
- Supported by HKCTC & local food industry
- Licensed to multi-national certification bodies

Risk Analysis & Toxicology

Risk – benefit Analysis of Fish Commonly Consumed in Southern Part of China

PI: Prof. Samuel LO, Dr. Kevin KWOK, & Dr. Ka-sing LEUNG

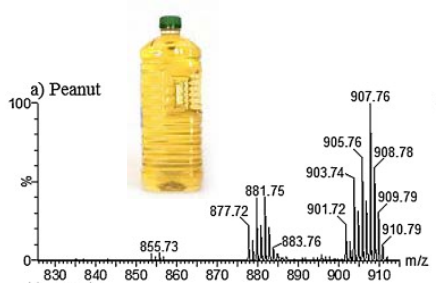
- Part of an national project, and in collaboration with GDCDC & China National Center for Food Safety Risk Assessment
- To construct a national database on methyl-mercury & polyunsaturated fatty acids of fish commonly consumed in China

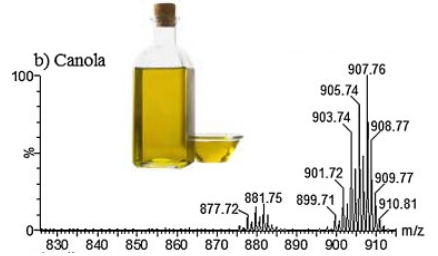
Novel Food Technology Development

Establishment of A Mass Spectral Database for Rapid Authentication of Edible Oils Using MALDI-MS

PI: Dr. Zhongping YAO

- Establish a MALDI-MS spectral database of edible oils
- Determine the authenticity of an edible oil sample within 5 min based on a unique MALDI-MS spectral pattern
- Funded by ITF-ITSP (Tier 3); Innovation & Technology Commission
- Collaborated with Nestlé R&D (China) Ltd.
- CFS funded consultancy project: Developing guidelines on good practice of using frying oil in Hong Kong





新法五分鐘篩查地溝油

地溝油風波早前由台灣蔓延至本港，令港人人心惶惶，更關注食安問題。

香港理工大學應用生物及化學科技學系最新研發「基質輔助激光解吸電離質譜」技術，可快速鑒別食用油和篩查地溝油，只需五分鐘，即可確認食用油樣本的真偽，每個樣本成本只需五十元，比較傳統方法，分析一個樣本要四至五個小時，每個成本五百元，可謂省時又慳錢。

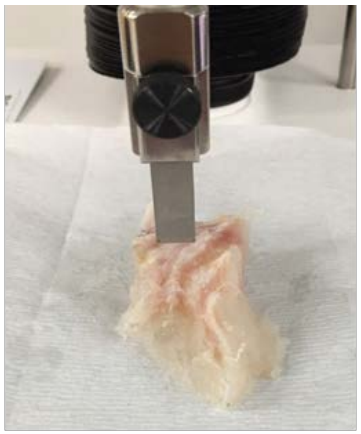
該學系副教授姚鐘平（見圖）解釋，新技術的原理，是將油類樣本載入基質樣本靶，以激光分析樣本，建立常用食用油的譜圖數據庫，只要將樣本譜圖與數據庫譜圖比較，就可在五分鐘內鑒別樣本真偽。

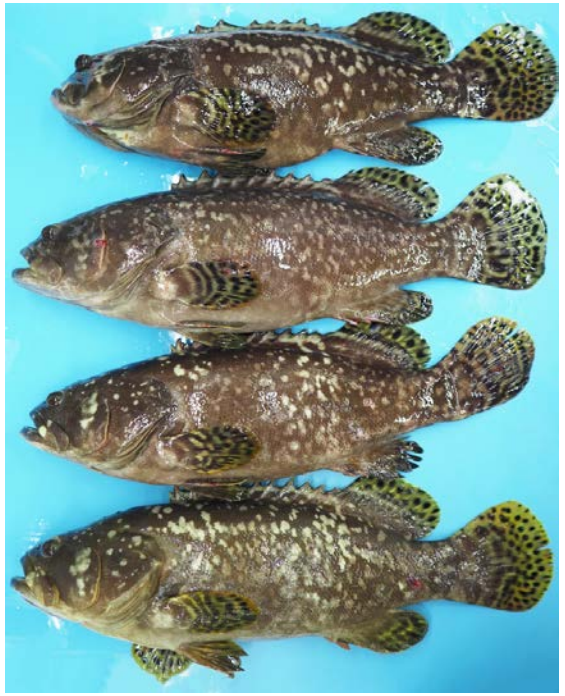
Novel Food Technology Development

Improving Meat Quality of Cultured Giant Grouper

PI: Dr. Kevin KWOK

- Investigate the effects of algae supplement (fish feed) on meat quality (hardness & gumminess, DHA, collagen) in cultured giant grouper
- Funded by ITF-ITSP (Tier 2); Innovation and Technology Commission
- Collaborated with Aquaculture Technologies Asia (R&D) Ltd.





Novel Food Technology Development

Research Laboratory for Sustainable Urban Green Agriculture

PI: Dr. Kahing WONG, Dr. Kevin KWOK & Dr. Daniel MOK

- Develop the next generation Urban Agriculture model (e.g. precision hydroponics)
  - ✓fit for small indoor space of HK
  - ✓allow cultivating high quality, accessible fruits & vegetables for direct & healthy consumption
- Optimization & standardization by physico-chemical & metabolomic approaches in terms of nutritional value, safety & sensory quality

Food Microbiology

Shenzhen Key Laboratory for Food Biological Safety Control
深圳食品生物污染與控制重點實驗室

Antimicrobial Resistance and Pathogenesis

PI: Prof. Sheng CHEN

- Molecular mechanism of antimicrobial resistance under antibiotic pressure in animal gastrointestinal tract
- Funded by China National Basic Research Programme (973 Project)

Food Microbiology

Discovery of a newly emerged superbug – hyper-resistant & hypervirulent *Klebsiella pneumoniae*

PI: Prof. Sheng CHEN

A fatal outbreak of ST11 carbapenem-resistant hypervirulent *Klebsiella pneumoniae* in a Chinese hospital: a molecular epidemiological study

Danxia Gu, Ning Dong*, Zhiwei Zheng, Di Lin, Man Huang, Lihua Wang, Edward Wai-Chi Chan, Lingbin Shu, Jiang Yu, Rong Zhang, Sheng Chen*

Summary

Background Hypervirulent *Klebsiella pneumoniae* strains often cause life-threatening community-acquired infections in young and healthy hosts, but are usually sensitive to antibiotics. In this study, we investigated a fatal outbreak of ventilator-associated pneumonia caused by a new emerging hypervirulent *K pneumoniae* strain.

Lancet Infect Dis 2017

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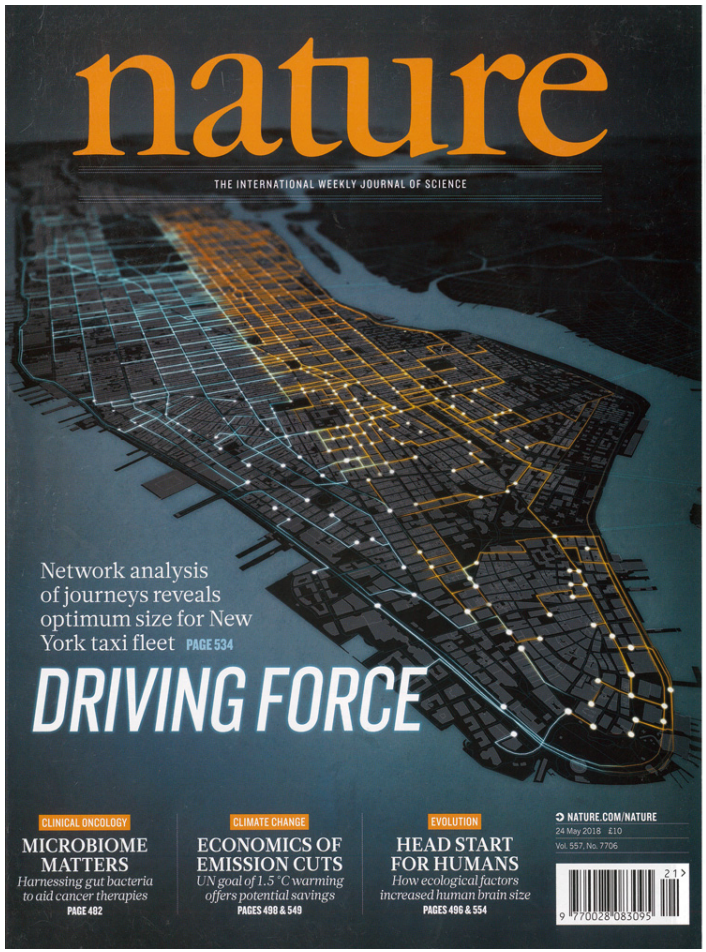
http://www.thelancet.com/journals/laninf/article/PIIS1473-3099(17)30489-9/fulltext

Food Microbiology

Discovery of a newly emerged superbug – hyper-resistant and hypervirulent *Klebsiella pneumoniae*

PI: Prof. Sheng CHEN



SPOTLIGHT ON HONG KONG

Discovery of a new superbug

A molecular study by a researcher at THE HONG KONG POLYTECHNIC UNIVERSITY has led to the discovery of an emerging superbug and the mechanisms underlying fatal infections.

A researcher at The Hong Kong Polytechnic University (PolyU) has discovered a superbug that may cause pneumonia to become fatal.

Pneumonia is usually a treatable respiratory infection. But an outbreak of the condition in a Zhejiang hospital in 2016 killed five patients whose severe pneumonia eventually led to septicaemia and multiple organ failure.

An investigation by Chen Sheng, a professor of PolyU's Department of Applied Biology and Chemical Technology, in collaboration with Zhang Rong from the Second Affiliated Hospital of Zhejiang University, found the culprit in a carbapenem-resistant *K. pneumoniae* (CRKP) strain, a type of a previously-defined superbug. All strains from the five patients belonged to the ST11 type, the most prevalent and transmissible CRKP in Asia. These pathogens, with genes resistant to carbapenem and other common antibiotics, make infections hard to treat. Further acquisition of hypervirulence plasmids would make these strains evolve into a real superbug, known as ST11 carbapenem-resistant hypervirulent *K. pneumoniae* (ST11-CR-HvKP), which is simultaneously hyper-resistant, hypervirulent and highly transmissible.

This superbug, detectable by the polymerase chain reaction (PCR) method, not only infects lungs and cause pneumonia, but also invades the bloodstream and other organs. Its hypervirulence and phenotypic resistance to common antibiotics make the infections incurable even for healthy people with normal immunity.

According to Chen's study, even colistin, the last-resort drug for carbapenem-resistant infections, used alone or in combination with other drugs, is ineffective in fighting ST11 CR-HvKP. Ceftazidime/avibactam might be more successful, but clinical data from the United States suggests ST11 CR-HvKP may quickly develop resistance to this antibiotic.

ST11 CR-HvKP strains proliferate in the human intestinal tract and possess a mucoid outer layer, which enables them to adhere to various materials, including the surface of medical devices and other surfaces in a hospital setting. Chen's data shows that medical equipment, such as ventilators and catheters, might be transmission sites for these new strains. Human-to-human transmission may also be possible, but clinical settings are most vulnerable.

"Improved infection prevention is needed to control further transmission of this superbug in the ICU," says Chen. "This calls for novel prevention strategies."

In Hong Kong, the prevalence of ST11 CR-HvKP strains was previously unknown. To address this issue, the research team screened patients in Hong Kong hospitals and found that the prevalence of CRKP among clinical *K. pneumoniae* strains remains low. However, CR-HvKP was detected among CRKP strains.

"We need to be cautious about this newly emerged, highly transmissible strain," says Chen. "More extensive molecular epidemiological studies are required to assess the potential threat it might pose to the healthcare system in Hong Kong in the near future." ■

* The results of the study were published in the *The Lancet Infectious Diseases* in August and November 2017.

Professor Chen Sheng
Phone: (852) 3400 8795
Email: sheng.chen@polyu.edu.hk
Website: http://www.polyu.edu.hk/abct

Functional Food Development

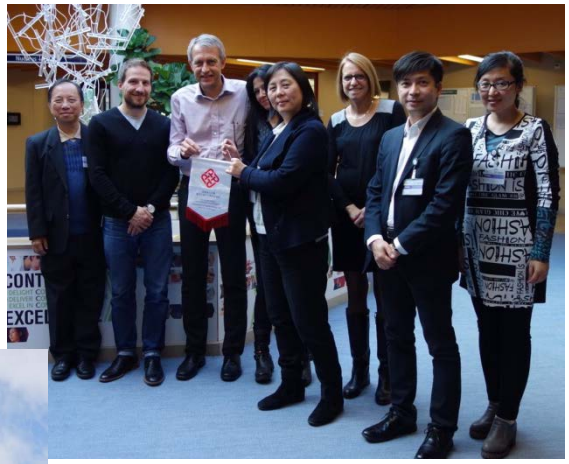
Development of Traditional Chinese Medicine based Functional Food

PI: Prof. MS WONG

Nestle Co. Ltd Funded Consultancy Projects

Consultancy Project Ⅰ (2010-2011)
Effects of *Fructus Ligustri* Lucidi (FLL) and Puerariae Radix (PR) on Calcium Metabolism and Bone Properties in Ovariectomized Rats

Consultancy Project Ⅱ (2013-2014)
Efficacy Evaluation and Functional Analysis of Calcium/Vit.D/Zn Fortified Diet and Ca/Vit.D/Zn plus Lacto-wolfberry Diet on Calcium Metabolism and Bone Properties in Aged Normal and Ovariectomized (OVX) Rats



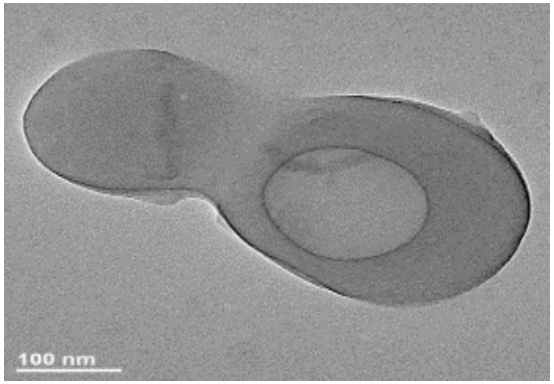
伊利

Functional Food Development

Health Benefits and Safety Evaluations of Nanoencapsulated DHA on Fetal and Infant Brain Development Using C57BL/6J Mice Model

PI: Dr. Yi WANG & Prof. MS WONG

- Develop nanoencapsulated DHA using zein
- Improved absorption of DHA in both duodenum & jejunum;
- Improved biodistribution of DHA in the brains of both mother & offsprings of mice model
- Enhanced performance in mice cognitive function development (Learning & memory)
- Increased concentration of Brain-derived Neurotrophic Factor (BDNF) in hippocampus
- Funded by HMRF; Food and Health Bureau

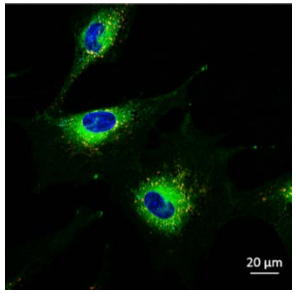


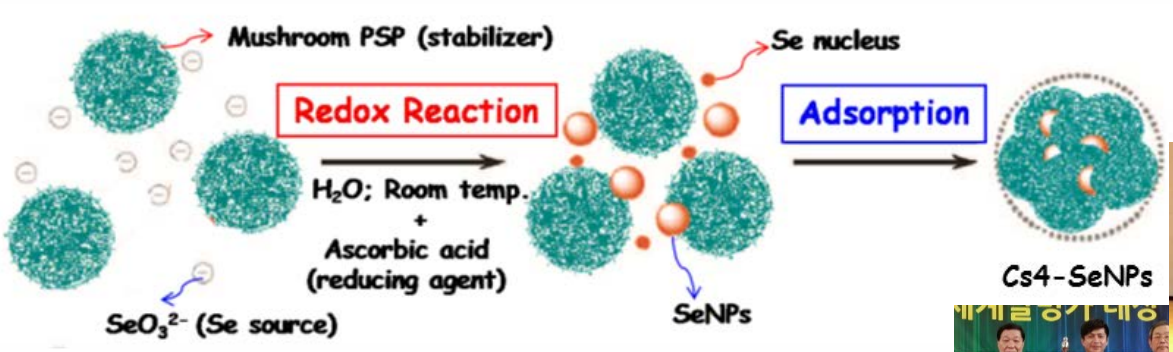
Functional Food Development

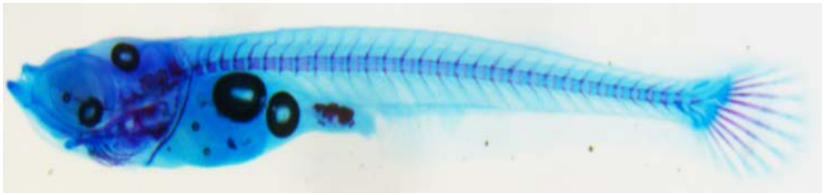
Developing the Next Generation of Bone Protective Agent using *Cordyceps sinensis*

PI: Dr. Ka-hing WONG

- Prepare novel selenium nanoparticles by Cs4 polysaccharides using myco-nanotechnology
- Evaluate the bone protective efficacy of Cs4-SeNPs using different *in vitro* & *in vivo* models
- Funded by ITF-ITSP (Tier 2); Innovation & Technology Commission
- Collaborated with Hua Ming Xing Ye Biotechnology Ltd.





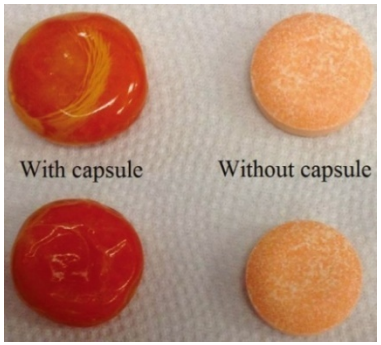


Functional Food Development

Preparation of Food Grade Capsules for Targeted Drug/Functional Food Delivery

PI: Dr. Yi WANG & Dr. Ka Hing WONG

- Develop novel capsule for targeted drug/functional food delivery using zein and pectin
  - Zein & pectin: food grade, plant-based & under-utilized byproducts
  - Safe, fit for vegetarians and inexpensive
- Targeted delivery to stomach, small intestine, or colon
- Chinese patent file no.:201410130730.3
- Gold Medal & Thailand Award for the Best International Invention; 42nd International Exhibition of Inventions of Geneva, Geneva, Switzerland



Functional Food Development

PolyU-NTU Research Collaboration in Functional Food Development

PolyU's Food Safety & Technology Research Centre

NTU's Institute of Food Science & Technology

Nutrition and Public Health

Establishment of Hong Kong's First Breast Milk Nutrient Database

PI: Prof. MS WONG

- Establish the first nutrient database on breast milk from local lactating women
- Supported by HK Breastfeeding Mothers' Association & La Leche League Hong Kong

香港母乳育嬰協會
HONG KONG BREASTFEEDING MOTHERS' ASSOCIATION

自然育兒網絡
Natural Parenting Network

媽媽牌
MaMaMilk

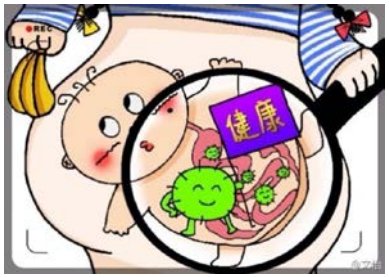
國際母乳會-香港 LA LECHE LEAGUE HONG KONG

Nutrition and Public Health

Study on Gut Microbiota in Hong Kong Populations

PI: Prof. MS WONG & Dr. Amber CHIOU

- Establish the first gut microbiota database from both breastmilk-fed and infant formula-fed infants in Hong Kong
- Funded by HMRF



PI: Prof. MS WONG

- Study the effect of dietary intervention on gut microbiome in Hong Kong obese population
- Dietary intervention: Polyunsaturated fatty acids & whole grains
- Funded by a local biotechnology company

Education and Professional Development

PolyU-UMD Joint Food Safety Training Programme

PolyU's Food Safety & Technology Research Centre

UMD's Joint Institute for Food Safety & Applied Nutrition (JIFSAN)

Education and Professional Development

MSc in Global Food Safety Management & Risk Analysis

- **Programme Aims:**

✓ To provide a unique & professional oriented training on global food safety management and risk analysis for science / technology graduates who want to develop their expertise in the area of food safety

✓ To provide students with advanced knowledge in the major and newly emerging hazards affecting food safety from a global perspective

1st intake: September 2019 !!

First of Its Kind

It is the first MSc programme in existing market focus on "Global Food Safety Management" and "Risk Analysis" in Hong Kong.

Multiple Qualifications

In addition to MSc graduate certificate, students are qualified to obtain:

- **An JIFSAN Core Programme Certificate in Food Safety Risk Analysis issued by JIFSAN & PolyU;**
- **An ISO22000 Certificate issued by an accredited Certification Body**

International Teaching Team

Lectures will be delivered by academics, renowned experts and experienced practitioners in the field of "Food Safety" from all over the world.

Thank You!!

Food Safety & Technology Research Centre
Department of Applied Biology and Chemical Technology
The Hong Kong Polytechnic University

Tel: +852 3400 8860 / 8859
Email: bcfstrc@polyu.edu.hk
Website: www.polyu.edu.hk/abct/fstrc

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