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研究興趣

• 提升微藻養殖工程技術，用於微藻養殖減碳、綠能產製，以及開發高值化之微藻生物活性物：

微藻(microalgae)具高效能光合作用，可有效率利用陽光，將CO_2轉換成生物能(biomass)，微藻並富含許多生物活性物質，是近年來深具研發價值之主題。本研究室跟許多大學研究室，財團法人研究機構，以及上市公司等單位合作致力於微藻減碳、生質能源、水資源再利用等研究，而長期研究目標包括：

- 建構戶外大規模單元操作的Photo-bioreactor/Raceway模組(20噸規模)，研發提升微藻養殖效能之工程操作模式。
- 篩選特種微藻株，其除具有高效率生長特性外，並富含特定生物活性物。
- 誘發微藻生產特定生物活性物質之養殖模式，探討其抑菌、抗氧化、細胞修復、提升免疫力等之生物功能性。
- 開發能用於飼料添加、產製機能性健康食品之微藻製品。

• 建立動物模式探討疾病機轉與治療：

本研究室利用分子生物學技術、細胞及實驗動物進行一系列in vitro和in vivo實驗，探討腎素-血管收縮素系統(renin-angiotensin system, RAS)的失調、高血糖、肥胖與心臟、肺臟、腎臟及代謝性疾病的關係，我們利用db/db與ACE2雙基因剔除(gene knockout)小鼠建立糖尿腎病實驗動物模式並探討其病程機轉，也探討合併一些RAS調節藥物對減緩糖尿腎病的可能性，本項研究的長期目標為預防或治療糖尿腎病新藥或新療法提供基礎生醫科學之依據。本研究室也進行$PM_{2.5}$誘發慢性阻塞性肺疾病(COPD)與慢性疾病小鼠實驗模式之建立與探討，流行病理學研究已確立$PM_{2.5}$對於人體健康造成的嚴重影響，其中主要為提高呼吸道疾病、肺癌及死亡的風險。我們希望藉由本實驗動物模式的建立，日後可以據此模式與臨床醫師擴大合作研究的範圍，未來將探討不同代謝疾病(高血脂、高血糖、高血壓)對$PM_{2.5}$暴露的敏感度與病程發展的影響。

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Research Interests

• Using microalgal technology for carbon dioxide reduction, wastewater utilization, biofuel production, and producing high value microalgal byproducts

Microalgae with high-performance photosynthesis, can effectively use sunlight, convert CO_2 into biomass, and microalgae are rich in many bioactive substances which are the subjects of research and development in recent years. Our laboratory has cooperated with several laboratories in university, research institutes, and industrial companies on the studies of carbon reduction, biomass energy production, waste water treatment and reuse by microalgal cultivations. Long-term research objectives of our laboratory include:

- constructing a large-scale Photo-bioreactor /Raceway module (20 tons scale) for promoting microalgal culture efficiency;
- screening special microalgal strains which have the potential of high-efficiency growth and enriched with specific bioactive substances;
- inducing the microalgae to produce specific bioactive substances and exploring their biological functions, such as antibacterial, anti-oxidation, cell repair, and immunity enhancement;
- developing microalgal by-products that can be used for feed addition and production of functional health foods.

• Establishing animal models for the studies on disease mechanism and therapy

Our laboratory uses molecular biology techniques, cells and experimental animals to conduct a series of in vitro and in vivo experiments to explore the renin-angiotensin system (RAS) disorder related with heart, lung, kidney and diabetes diseases. We used db/db and ACE2 double gene knockout mice to establish experimental models of diabetic nephropathy and explored its pathogenesis, and also study the combination of some RAS regulating drugs to treatment the induced disease. The long-term goal of this study is to provide the basis for basic biomedical science for the prevention or treatment of new drugs or therapies for diabetic nephropathy. Our laboratory also established the experimental animal model of $PM_{2.5}$-induced chronic obstructive pulmonary disease (COPD) and other chronic diseases. Epidemiological studies have gradually established the serious impact of $PM_{2.5}$ on human health, mainly to improve respiratory diseases, lung cancer and the risk of death. We hope that with the experimental animal model, we can expand the scope of collaborative research with clinicians in the future. We will explore the sensitivity and pathogenesis of different metabolism diseases, such as hyperlipidemia, hyperglycemia and hypertension, to environmental $PM_{2.5}$ exposures.