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## 研究興趣

本實驗室研究主題為

### (A) 抗體標靶化微脂體在癌症診斷及治療之應用

我們開發了具有EGFR標靶的熱敏多功能微脂體(ERB-TSML)，該微脂體由摻雜錳的磁性奈米氧化鐵以及金奈米棒和阿黴素所組成。ERB-TSML具有多種功能，例如具有選擇性標靶和治療效果。此外，包裹的金納米棒和阿黴素表面上的Erbitux可以增強生物體內針對EGFR過度表現的腫瘤的標靶性，並通過雷射激發對腫瘤達到光熱治療的效果。此外，它還增強了T2 weighted MR呈像的效果，ERB-TSML在給予電射後顯著的抑制了小鼠中腫瘤生長。開發的新型Erb-TSML對EGFR陽性腫瘤的治療為有效且具前景的治療方法。

### (B) 水溶性穩定一氧化氮釋放劑設計合成及其於血管新生、傷口癒合、癌症及阿茲海默症治療之應用

一氧化氮(NO)為是生物體內重要多功能訊息傳導分子且同時參與許多生理與病理過程，例如:在心血管系統中具有活化內皮細胞的轉移、生長、內皮細胞屏障功能之調節作用；在中樞神經系統中一氧化氮具有神經保護作用；一氧化氮具有抑制腫瘤細胞生長及促進腫瘤細胞凋亡的功能，本團隊開發一系列水溶性及穩定之一氧化氮釋放劑，透過其可直接釋放一氧化氮並且提高一氧化氮的釋放效率之特性，將其應用於血管新生、傷口癒合、癌症及阿茲海默症之治療與作用機制探討，並期待此一系列一氧化氮釋放劑發展為血管新生、傷口癒合、癌症及阿茲海默症之潛力藥物並應用於臨床醫學上。

### (C) 光學影像探針之開發

螢光檢測是感測和成像化學物種的有用工具，因為其靈敏性、不具傷害性且檢測快速。已知在包括活性氧化物種、活性氮化物種和活性硫化物種在內的生物活性物種的生理過程中起著重要作用。我們積極參與開發多種螢光探針，以檢測nitric oxide, nitroxyl, peroxynitrite, hydrogen sulfide等。並對不同的探針進行光學研究，在存在和不存在生物活性物質的情況下進行實驗以評估合成探針的光學性質。我們亦使用共軛焦顯微鏡對活體細胞進行進一步的螢光成像研究。

### (D) 具光動力及光熱療法之奈米金團簇之開發

本研究為設計及合成出多功能奈米金團簇，可同時提供臨床的磁振造影診斷、抗癌藥物釋放、局部自由基釋放的腫瘤光熱及光動力治療效果，將含有多種功效的材料結合為一體，並使得癌症之診斷與治療技術結合。所建構之奈米團可藉吸收近紅外光能量並轉換為熱能達到局部升溫，對於腫瘤區塊有絕佳治療效果，且不影響周遭正常細胞之生長，可有效降低患者的不適性與縮短治療時程。

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## Research Interests

### • Application of Thermal Sensitive Multifunctional Liposome for Theranosis

We developed EGFR-targeting thermal-sensitive multifunctional liposome (ERB-TSML) composed of manganese-doped magnetism-engineered iron oxide nanoparticles, gold nanorods and doxorubicin. The developed ERB-TSML has multimodal diverse functions, such as selective targeting and therapy. Moreover, the conjugation of Erbitux on the surface of encapsulated gold nanorods and doxorubicin could enhance selective targeting towards EGFR-overexpressing tumors in vitro and in vivo and mediate photothermal destruction of tumors by laser activation. In addition, it has improved T2 weighted MR imaging platform and ERB-TSML with laser treatment significantly suppressed the tumor growth in mouse models. The developed novel Erb-TSML represent a promising theranostic strategy for EGFR-positive tumors.

### • Synthesis of NO-Releasing Agents for Angiogenesis, Wound Healing, Anticancer and Alzheimer's disease.

Nitric oxide (NO) is a multifunctional signal molecule which can not only activate the growth of endothelial cell but also regulate vascular endothelial barrier function in the cardiovascular system. NO also expresses the protective effect in the central nervous system. NO shows the ability to inhibit cancer cell growth and induce cancer cell apoptosis. A series of structurally well-characterized and water-soluble NO-releasing agents was developed which display more efficient and direct releasing NO. The aim of this study is to determine the treatment of NO-releasing agents for in angiogenesis, wound healing, and Alzheimer's disease. Therefore, we further anticipate these agents will exploit as angiogenesis, wound healing, anticancer and Alzheimer's disease drugs on clinical medical applications.

### • Optical Fluorescent Probe for Detection of NO-, NO, H2S, ONOO-, Cysteine …

Fluorescence detection is a useful tool for sensing and imaging of chemical species. It is known that bioactive species including reactive oxygen species, reactive nitrogen species, and reactive sulfur species are being played important roles in several physiological processes. Our group actively participates in the development of several kinds of fluorescent probes to detect nitric oxide, nitroxyl, peroxynitrite, hydrogen sulfide, etc. Different photophysical experiments such as absorption, fluorescence, time-dependent, selectivity, pH measurements and other related optical studies are carried out in the absence and presence of bioactive species to assess the optical properties of the synthesized probes. The study result prompts us to conduct further fluorescence imaging studies in live cells and in vivo using confocal microscopy.

### • Development of Gold Nano-materials Photothermal and Photodynamic Therapy

In this study, a multifunctional gold nano-materials was designed and synthesized, which can simultaneously clinical provide magnetic resonance imaging diagnosis, anti-cancer drug release, photothermal and Photodynamic therapy effect of free radicals in local release. Combines materials that contain multiple efficacies and allows for the simultaneous diagnosis and treatment of cancer. The synthesized nano-materials can achieve local heating by absorbing near-infrared light energy and converting it into heat, it has outstanding photothermal therapeutic efficacy and without damage to the surrounding tissue , which can effectively reduce the patient's discomfort and shorten the treatment time course.