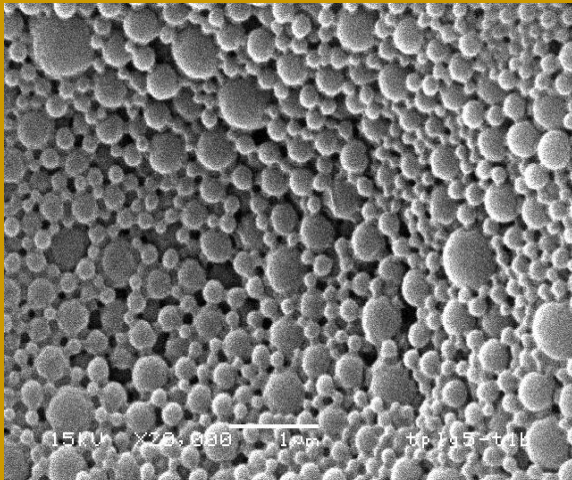


Chemotherapeutic Engineering ...

Applying chemical engineering to solve problems in chemotherapy, cardiovascular restenosis and AIDS



SEM image of paclitaxel-loaded, Vitamin E TPGS emulsified PLGA nanoparticles, 100% drug encapsulation efficiency has been achieved (bar = 1 μ m)

Cancer & cardiovascular diseases are the leading causes for human mortality, which caused, respectively, 28.2% & 26.3% of deaths in 2001 in Singapore. Chemotherapy is one of the most effective treatments for these diseases. However, high risks exist due to drug toxicity, low efficacy and side effects, which are caused by problems in dosage form, pharmacokinetics and drug resistance. Engineering, especially chemical engineering principles, can be applied to develop controlled and targeted delivery systems to solve these problems. Broadly speaking, any application of drugs for any disease could be considered to be a form of chemotherapy. Chemotherapeutic engineering can thus substantially change the current regime of the entire internal medicine in the new millennium.

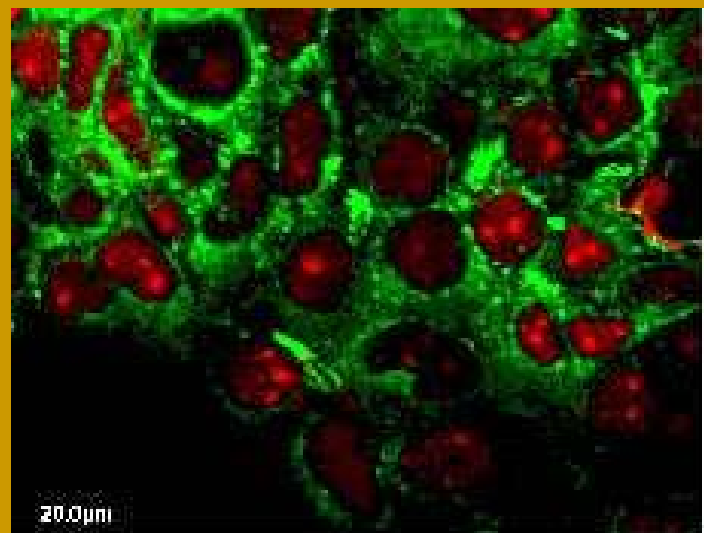
The Chemotherapeutic Engineering Laboratory at the National University of Singapore currently focuses on developing novel drug delivery devices, including nanoparticles of biodegradable polymers, lipid bilayer vesicles (liposomes) and their combinations. Paclitaxel has been used as prototype drug due to its high efficiency against a wide spectrum of cancers and its great commercial success in the world market. The progress includes

- Formulation with no poisonous adjuvant, e.g. no Cremophor EL for paclitaxel;
- Controlled & targeted delivery;
- Oral chemotherapy – a new concept of chemotherapy, “Chemotherapy at Home”;
- Nanoparticles for cardiovascular tissue repair;
- To cross the blood-brain barrier for brain cancer chemotherapy and treatment of AIDS & Alzheimer’s.

We have shown by HT-29 & Caco-2 cell lines that paclitaxel formulated in Vitamin E TPGS emulsified PLGA nanoparticles can be greater than sixteen times more effective for cell viability than the free drug Taxol® after 24 hours culture in the same drug concentration. Animal tests and clinical trials are under development.

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Contact:
A/Prof. Feng Si-Shen
Tel: 6516 3835
Email: chefss@nus.edu.sg



Confocal microscopic image of HT-29 cells after exposed to vitamin E TPGS-coated, Coumarin-6-loaded nanoparticles for 1 hr at 37°C, followed by nucleus staining using propidium iodide (bar =20 μ m).