Chemical Engineering

Jui-Che Lin (林睿哲教授)

Professor

B.S.	Chemical Engineering, National Cheng Kung University, Tainan, Taiwan	1987
Ph. D.	Chemical Engineering, University of Wisconsin-Madison, USA	1994
Phone	886-6-2757575-62665	
Email	jclin@mail.ncku.edu.tw	
Office	Room 93C16, Chemical Engineering Building	

Research Interests:

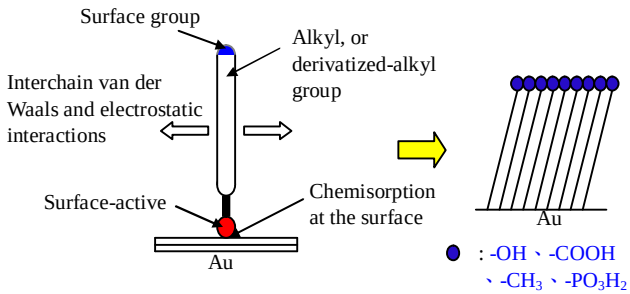
Biomaterials, Biomedical Engineering, Physical Chemistry of Polymer Surfaces

The research activities in our laboratory focus mainly in two areas: (1) study of the interactions between the biological environment and biomaterial surface with an aim to improve material's biocompatibility; (2) molecular design, synthesis and characterization of new biocompatible materials or biodegradable polymers.

Study of the interactions between the biomaterial surface and proteins or platelets:

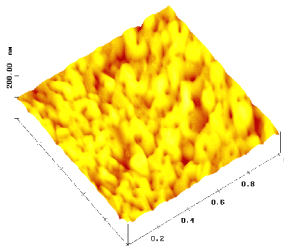
In order to elucidate the relationships between the biological responses and surface properties of biomaterials, our lab has synthesized a series of novel alkanethiols with various bio-inspired terminal functional groups to form a self-assembled monolayer (SAM) with well-defined chemical configuration. Various surface analysis techniques, such as ATR-FTIR, ESCA, AFM and contact angle measurement are utilized to characterize the SAM substrates. In addition, several *in situ* techniques, including a home-designed flow cell with ATR-FTIR analysis capability for semi-quantitative analysis of protein adsorption, radioactive tracer technique, and *in vitro* platelet adhesion assay are employed to study the dynamic interactions between blood and biomaterial's surface.

The Chemical Configuration of SAM

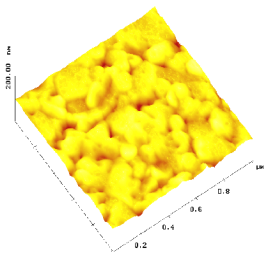


: -OH、-COOH 、$-SO_3H$ 、$-CH_3$、$-PO_3H_2$ phospholipid

Atomic Force Microscopy

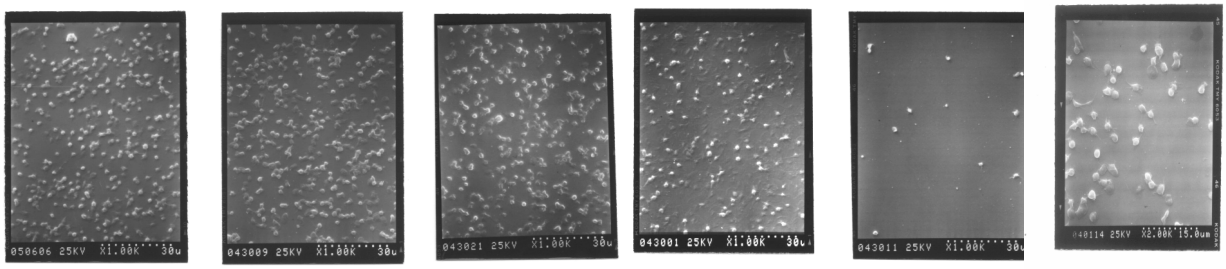


Au substrate, Ra=3.7nm, Zmax=33.6nm



SAMs with $-SO_3H$ terminal functionality Ra=3.2nm, Zmax=34.4nm

In vitro Platelet Adhesion Assay



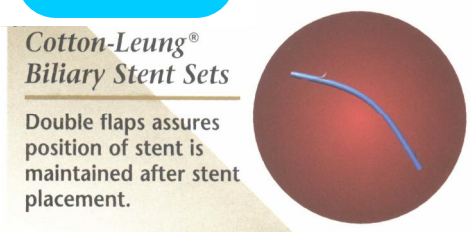
Au control | -COOH | -SO_3H | -CH_3 | -OH | -PO_3H_2

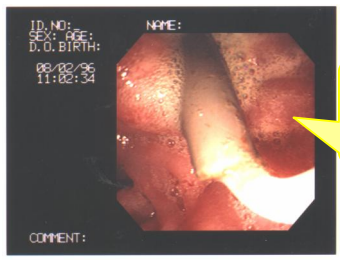
The SEM micrographs of adhered platelets on SAMs with various terminal functionalities: -OH (1.7±0.5) < -CH_3 (21±3.5) < -PO_3H_2 (33±1.1) ≈ -SO_3H (35±2.6) < -COOH (41±3.3) ≈ Au (44±2.9) (platelets/1000mm^2)

Synthesis of Novel Biomaterials:

Surface immobilization of antithrombogenic biomolecules, such as hirudin, thrombomodulin or heparin, and surface grafting of various functionalities are performed to improve material's biocompatibility or blood compatibility. In addition, a novel polyurtheane is proposed as a potential candidate for biliary stent application to improving its patency, leading to a reduction in reoccurrence in obstructive jaundice. These two projects are closely cooperated with the clinical and basic medicine professionals.

Biliary Stent



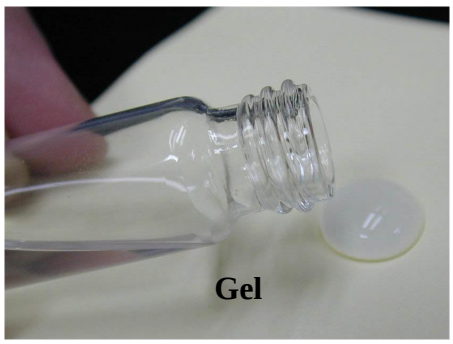


Insertion of Biliary Stent

Synthesis and Chemical Modification of Biodegradable Polymer: Chitosan

Since chitosan, the second most abundant polysaccharide on earth, can be safely metabolized within the human body as well as carry a wide range of bacteriostatic capability, our lab has greatly involved in the synthesis and modification of this novel biomaterial with an aim to improve its hemocompatibility and its solubility within biosafe organic solvents. This effort has led to a development of novel photocrosslinked drug delivery vehicle and tissue scaffold.

UV irradiation



Publications:

28 papers have been published in peer reviewed international journals.