

Chih-Chang Chu

Web Bio

Information

Biography

Biographical Statement

Dr. C.C. Chu joined the Cornell faculty in 1978 after completing postdoctoral research on biomaterials for maxillofacial prostheses at the Medical Center of the University of Alabama in Birmingham. He had held visiting appointments in the Department of Dental Science at University of Liverpool in the UK, at the National Yang-Ming Medical College in Taiwan, at Hahnemann University School of Medicine in Philadelphia and in the Division of Mechanics and Materials Science, Center for Devices and Radiological Health at the U.S. Food and Drug Administration. He has served on the editorial boards of The Open Macromolecules Journal, The Open Material Science Journal, The Open Biomaterials Journal, J. Fiber Bioengineering and Informatics, and J. Bioengineering and Biomedical Sci. He also served on the board of directors for the Society of Plastic Engineers (medical plastics division) and was on the editorial board of the Journal of Investigative Surgery. Dr. Chu is also the member of the Biology/Medicine Panel of Hong Kong Grant Research Council. Dr. Chu earned a B.S. in Chemistry from Tamkang University and a Ph.D. in polymer science from Florida State University.

Dr. Chu focuses on the study of biomaterials, particularly the design and synthesis of novel biodegradable polymers/fibers/fabrics for tissue regeneration and repair including vascular grafts, wound closure and drug control/release purposes. This also includes the design and evaluation of novel biologic active biodegradable polymers for surgical repair of injured, diseased or aged tissues, and their impact on wound infection and healing. In basis research, Dr. Chu's interests include the mechanisms of degradation of biomaterials, theoretical understanding of the effects of chemical structure on degradation through supercomputer molecular modeling, and exploring both intrinsic and extrinsic factors that could affect the degradation properties, such as the role of free radicals in degradation of biomaterials. His research activities also include the synthesis of new biodegradable polymers for immunotherapy of cancer patients, biomaterials for reducing restenosis of vascular stents, novel substrates for cell preservation and tissue engineering, biodegradable vascular grafts, functional wound closure biomaterials for eliminating wound infection during surgery and composite bone cement for orthopaedic surgery.

Dr. Chu has published over 165 research papers, a recipient of 63 US and international patents with many pending, an author and editor of the book "Wound Closure Biomaterials and Devices". One of Chu's new inventions 'Biodegradable, Bioactive, & Programable Hydrogels' was chosen as a semifinalist for Discover Columbus Foundation Award competition. Dr. Chu has experience working with industry and medical professions to bring his new inventions in

biomaterials to clinical reality. Dr. Chu teaches both undergraduate and graduate level courses. One course, “Biomaterials and Medical Devices for Human Body Repair”, nicknamed “Human Spare Parts”, is co-listed with the bioengineering curriculum, and has drawn students from all colleges at Cornell.

Professional

Research

Current Research Activities

Biologically active bioabsorbable polymers and fibers: The goal is to design and synthesis of amino acid based biodegradable poly(ester amide)s that could have many different types of reactive sites for chemical conjugation with biologically active agents. These new PEAs can also be fabricated via electrospinning into nanofibers or photocrosslinking into 3D microporous hydrogels. These nanofibrous membranes and hydrogels will be inherent chemical functional groups for chemical attachment or pre-loading of biological agents for treating a variety of diseases.

Durg- or biologics-impregnated hydrogels for a vareity of clinical use: The goal is to design biodegradable hydrogels that can be fabricated in an aqueous medium and can carry biologics or drugs for their sustained release to treat a variety of diseases. One particular project involves the delivery of growth factors like bFGF for improved skin regeneration of burn victims, and is collaborated with Prof. M. S. Jin of Dept. of Biomedical Engineering and Profs. R. Yurt/S. Schwartz of Weill Cornell Medical College.

Therapeutic biodegradable biomaterials for wound management of burn victims: The goal is to promote wound healing of burn victims by fabricating our new pseudo-amino acids into microfiber-based medical devices as artificial skins that would have the capability to release biological agents and would also have elastomeric mechanical property. This project is collaborated with Prof. Roger Yurt and Suzanne Schwartz of Cornell Burn Center and is funded by Cornell University.

Biodegradable carriers for Gene and DNA: The goal is to design and develop new synthetic carriers that could improve gene transfection efficiency with better cellular biocompatibility. This work is collaborated with Prof. Bo Liu and Craig Kent of Division of Vascular Surgery of Dept. of Surgery of Weill Cornell Medical College and is supported by a seed grant from Cornell University.

Biodegradable polysaccharide-based biomaterials for bone engineering and as synthetic extracellular matrix: The goal is to design and develop a novel class of anionic biodegradable scaffold biomaterials that could provide bone biomineralization for engineering new bones for repair bones. This project is collaborated with the Hospital for Special Surgery, an afflilated of Weill Cornell Medical College.

Biodegradable scaffold for heart valve tissue engineering: This project is to use multidisciplinary approach to develop biodegradable and blood biocompatible scaffold via 3D bioprinting process so that heart value leaflets could be regenerated. The project involves Prof. J. Butcher of Dept. of Biomedical Engineering and Prof. Leo Girardi of Weill Cornell Medical College.

Biodegradable nanospheres for diagnostic and therapeutic of cancers: The goal is to design and develop biodegradable nanospheres that can be selectively uptaken by tumor cells for both diagnostic and therapeutic purpose. The project is collaborated with Prof. Rasa Zarengar of Weill Cornell Medical College.

Effect of supercritical CO₂ sterilization on synthetic absorbable biomaterials, a project via the collaboration with a local company, NovaSterilis.

Cationic biodegradable polymers for treating prostate cancer, a project via the collaboration with Cornell Medical College.

Extension

Education

Education

- Postdoc 1978 - University of Alabama Chemistry
- Ph.D. 1976 - Florida State University Chemistry
- B.S. 1969 - Tamkang University, Taiwan, China Chemistry

Courses

Courses Taught

- BME 5390 - Biomedical materials and devices for human body repair
- FSAD 4360 - Fiber Chemistry
- FSAD 4390 - Biomedical Materials and Devices for Human Body Repair
- FSAD 6260 - The Chemistry of Textile Finishes and Dyeing

Websites

Related Websites

[Personal Website](#)

<http://www.chu.human.cornell.edu/>

[Chu's Patents Listed on the Cornell Center for Technology, Enterprise](#)

and Commercialization Website

http://www.cctec.cornell.edu/technology/patents/humec_patents.php

Human Ecology website

<http://www.human.cornell.edu/bio.cfm?netid=cc62>

Administration

Publications

Selected Publications

Only a few selected are listed here:

K. Guo and C. C. Chu, "Synthesis and Characterization of Poly--caprolactone-containing Amino Acid-based Poly(ether ester amide)s", *J. Appl. Polym. Sci.* (In Press)

H. Song and C. C. Chu, "Synthesis and Characterization of A New Family of Cationic Pol(ester amide)s and Their Biological Properties", *J. Appl. Polym. Sci.* (In Press)

Guoming Sun, **C. C. Chu**, "Biodegradable Nanospheres Self-Assembled from Complementary Hydrophilic Dextran Macromers", *Carbohydrate Polymers*, 86(2): 910-916, (2011).

E. Chkhaidze, D. Tugushi, D. Kharadze1, Z. Gomurashvili, **C. C. Chu**, R. Katsarava, "New unsaturated biodegradable poly(ester amide)s composed of fumaric acid, leucine and , -alkylene diols" , *J Macromol Sci Part A - Pure & Appl Chem.* 48(7): 544 - 48(7): 544 -555, (2011).

Mingxiao Deng, Jun Wu, Cynthia A. Reinhart-King, and **C. C. Chu**, "Biodegradable Functional Poly(ester amide)s with Pendant Hydroxyl Functional Groups: Synthesis, Characterization, Fabrication and *In Vitro* Cellular Response", *Acta Biomaterials* 7:1504-1515, (2011).

Jun Wu, Martha A. Mutschler, **C. C. Chu**, "Synthesis and Characterization of Ionic Charged Water Soluble Arginine-based Poly (ester amide)", *J. Mater. Sci. Mater in Med.* 22:469-479, (2011)

Joshua A. Horwitz, Katrina M. Shum, Josephine C. Bodle, MingXiao Deng, **C. C. Chu**, Cynthia A. Reinhart-King, "Biological performance of biodegradable amino acid-based poly(ester amide)s: Endothelial cell adhesion and inflammation in vitro", *J. Biomed. Mater. Res. Part A*, 95: 371-380 (2010).

Xuan Pang, Jun Wu, Cynthia Reinhart-King, and **C. C. Chu**, "Synthesis and characterization of functionalized water soluble cationic poly(ester amide)s", *J. Polym. Sci. Part A: Polymer Chemistry*, 48: 3758–3766. (2010).

Chao Zhong,, Jun Wu, C.A. Reinhart-King, **C. C. Chu**, "Synthesis, characterization and cytotoxicity of photo-crosslinked maleic chitosan-PEGDA hybrid hydrogels", *Acta Biomaterials*, 6(10):3908-3918, (2010).

9. Xuan Pang and **C. C. Chu**, "Synthesis, Characterization and Biodegradation of Poly(ester amide)s based Hydrogels", *Polymer*, 51: 4200-4210, (2010).

K. Guo and **C. C. Chu**, "Synthesis of Biodegradable Amino Acid-based Poly(ester amide) and Poly(ether ester amide) with Pendant Functional Groups", *J. Appl. Polym. Sci.* 117(6): 3386-3394, (2010).

Guoming Sun and **C. C. Chu**, "Impregnation of Tubular Self-Assemblies into Dextran Hydrogels", *Langmuir*, 26(4): 2831-2838, (2010).

Xuan Pang and **C. C. Chu**, "Synthesis, Characterization and Biodegradation of Novel Poly(ester amide)s and Their Functionalization", *Biomaterials*, 31(14): 3745-3754, (2010).

M.X. Deng, Jun Wu, C. Reinhart-King and **C. C. Chu**, "Synthesis and Characterization of Biodegradable Poly(ester amide)s with Pendant Amine Functional Groups and In Vitro Cellular Response", *Biomacromolecules*, 10(1): 14-20, (2009).

Chao Zhong and **C. C. Chu**, "Acid Polysaccharide-induced amorphous calcium carbonate (ACC) Films: Colloidal Nanoparticle Self-Organization Process", *Langmuir*, 25(5): 3045-3049, (2009).

Guoming Sun and **C. C. Chu**, "Self-Assembly of Chemically Engineered Hydrophilic Dextran into Microscopic Tubules", *ACS Nano* (Am Chem Soc.), 3(5): 1176-1182, (2009).

Sinhee Kim and **C. C. Chu**, "Fabrication and Characterization of a pure biodegradable polysaccharide hydrogel with Vitamin B2 as a photoinitiator", *J. Biomed. Mater. Res., Part B: Applied Biomaterials*, 91B: 390-400, (2009).

Kai Guo and **C. C. Chu**, "Biodegradable and Injectable Paclitaxel-loaded Poly(ester amide)s Microspheres: Fabrication and Characterization", *J. Biomed. Mater. Res. Part B. Applied Biomaterials*, 89 (2): 491-500, (2009).

Lei Li and **C. C. Chu**, "Nitroxyl Radical Incorporated Electrospun Biodegradable Poly(ester amide) Nanofibrous Membranes", *J. Biomater. Sci. Polymer Ed*, 20: 341-361, (2009).

D. Q. Wu and **C. C. Chu**, "Cationic poly(VCL-AETA) hydrogels and ovalbumin (OVA) release in Vitro", *J. Mater. Sci. Materials in Medicine*, 19: 3593-3601, (2008).

C. C. Chu and Dajun D. Sun, "New electrospun synthetic biodegradable poly(ester amide) drug-eluting fibrous membranes for potential wound treatment", AATCC Symposium Proceeding "Medical, Nonwovens, and Technical Textiles", Oct.. 6-7, 2008, Durham, NC, pp. 60-76.

Dai Yamanouchi, Jun Wu, Andrew N. Lazar, K. Craig Kent, **C. C. Chu**, Bo Liu, “Biodegradable arginine-based poly(ester-amide)s as non-viral gene delivery reagents”, *Biomaterials*, 29(22): 3269-3277, (2008).

G. M. Sun, X. Z. Zhang and **C. C. Chu**, Effect of the molecular weight of polyethylene glycol (PEG) on the properties of chitosan-PEG-poly(N-isopropylacrylamide) physical hydrogels”, *J. Mater. Sci. Materials in Medicine*