Macromolecular Science & Engineering

39th Annual Symposium

October 22, 2015

Polymers and Their Biomedical Applications

Featuring Invited Talks By:
Professor Krzysztof Matyjaszewski
Professor Guillermo Ameer
Professor Tatiana K. Bronich
Professor Arthur J. Coury
Professor Kristopher A. Kilian
Professor Hai-Quan Mao

Symposium Committee:
Professor Peter X. Ma, Committee Chair
Professor Brian J. Love
Professor Ariella Shikanov
Ming Dang, Doctoral Student
Renato Navarro, Doctoral Student
**39th Annual Symposium – October 22, 2015**
Macromolecular Science and Engineering

**Polymers and Their Biomedical Applications**

8:00 – 8:30  Check In & Breakfast

8:30 – 8:45  Welcome

8:45 – 9:30  **Professor Arthur J. Coury**
Northeastern University
*Translation of Polymeric Biomaterials to Successful Commercial Medical Components and Devices: Multifactorial Considerations*

9:30 – 10:15  **Professor Tatiana K. Bronich**
University of Nebraska Medical Center
*Engineering of Soft Nanomaterials for Drug Delivery: Opportunities and Challenges*

10:15 – 10:50  Poster Session & Coffee Break

10:50 – 11:10  **Si-Eun Kim**
Case Western Reserve University
*Antifouling Co-extruded PCL Nanofiberous Mats*

11:10 – 11:30  **Omer Aydin**
University of Michigan
*Nanodroplet Mediated Histotripsy (NMH) Cell Ablation on 3D Prostate Cancer Cell Models*

11:30 – 12:15  **Professor Guillermo Ameer**
Northwestern University
*Engineering Citrate-based Macromolecules to Regenerate Tissue Function*

12:15 – 1:45  Lunch — Local Restaurants

1:45 – 2:30  **Professor Hai-Quan Mao**
Johns Hopkins University
*Controlled Polymer Assembly and Therapeutic Delivery*

2:30 – 3:15  **Professor Kristopher A. Kilian**
University of Illinois, Urbana-Champaign
*Engineering Hydrogels for Guiding Cell Decision Making*

3:15 – 4:15  Poster Session & Coffee Break

4:15 – 5:00  **Professor Krzysztof Matyjaszewski**
Carnegie Mellon University, Department of Chemistry
*Macromolecular Engineering by Taming Free Radicals*
Speaker Abstracts
Polymers comprise the most diverse category of biomaterials (materials which directly contact tissue as components of or as complete medical devices). From early implementation of commercial polymers in medical products to more recent developments in polymers designed for specific medical applications, this category of biomaterials has been crucial to the advancement of modern medical therapy and diagnosis. Medical therapy is evolving from “Replacement Medicine,” where biomaterials substitute for the structure and function of body components to “tissue engineering,” where we induce the body to heal or regenerate its tissues through molecular and cellular biological processes. Even so, polymeric biomaterials are indispensable in accomplishing delivery of tissue engineering technologies, and even being components of tissue engineering systems being delivered.

For regulated medical devices, polymeric biomaterials must pass a rigorous set of tests for safety and efficacy, ultimately in their final product form. However, performance considerations, and even regulatory approval of polymer-based medical devices, do not assure a commercially successful medical product. Dozens of "imperatives" must be realized to achieve a profitable product. Such variables should serve as a "checklist" to consider before deciding that a verified promising concept is worth developing further with the conviction, commitment and resources needed for success.
A special type of polymeric “soft” nanomaterials, nanosized hydrogels (nanogels), has been utilized in pharmaceutics for development of novel therapeutic and diagnostic modalities. They can be designed to facilitate the incorporation of a variety of compounds or even particles through a combination of electrostatic, hydrophobic, and hydrogen bonding interactions. Nanogel structure can be tuned to control the drug-release characteristics of the nanogel carriers. Recently, we have developed a new class of nanogels with controlled spatial distribution of polymer chains. Template-assisted synthesis of such nanogels involves self-assembly and subsequent cross-linking of doubly hydrophilic block copolymers (e.g. poly(ethylene oxide)-b-poly(carboxylic acid). The resulting nanogels possess swollen cores of crosslinked hydrophilic polyions surrounded by nonionic hydrophilic shell. The ionic character of the core provided for pH-dependent swelling behavior of the nanogels and allowed for the encapsulation of charged therapeutic molecules with very high efficiency. Hybrid nanogels containing hydrophobic domains in the ionic cores were designed to provide for combinatorial therapy resulting in simultaneous delivery of several anticancer drugs with very different physical properties and mechanisms of action. Chemical functionalization of nanogels with targeting moieties was also explored in order to enhance accumulation of highly toxic ingredients specifically within cancer cells and prevent their accumulation in healthy organs. The potential application of such hybrid nanogels as carriers for multidrug delivery will be discussed.
Antifouling Co-extruded PCL Nanofibrous Mats

Si-Eun Kim, Abigail A. Advincula, Jonathan K. Pokorski*

Department of Macromolecular Science & Engineering, Case Western Reserve University
2100 Adelbert Road, Cleveland, Ohio, 44106
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Biomedical applications such as sutures, wound healing patches and implantable devices require antifouling properties to prevent infections from bacteria, viruses and other organic contaminants when the biomaterial contacts wounded tissue or human blood. For such applications, we introduce antifouling co-extruded non-woven PCL nanofibrous mats. Our melt co-extrusion process used biocompatible poly(ε-caprolactone) (PCL) and poly(ethylene oxide) (PEO) to form a nanocomposite tape, where PCL nanofibers are embedded in a PEO matrix. After extruding the composite tape, PCL fibers were released by dissolving PEO in water. The PCL fibers were consolidated into a non-woven fiber mat using a high pressure water jet to entangle the fibers. Photochemistry was utilized to decorate propargyl benzophenone onto the fiber surface, yielding alkyne decorated fibers. To generate antifouling surfaces, we chose oligo (ethylene glycol) methyl ether methacrylate (OEGMEMA) for a hydrophilic polymer, 2-methacryloyloxyethyl phosphorylcholine (MPC) for a zwitterionic polymer and trifluoroethyl methacrylate (TFEMA) for a hydrophobic polymer. We synthesized these polymers by ATRP from an azide functionalized initiator and anchored the polymers onto the surface of fiber mat using traditional click chemistry. After decorating the surfaces with three different brushed polymers, the antifouling properties of the fiber mats were evaluated by protein absorption and bacteria testing. The TFEMA polymer grafted surface shows the best antifouling performance. These surface decorated fiber mats can open new windows for the commercial processing of antifouling nanofibrous nonwovens.
Nanodroplet Mediated Histotripsy (NMH) Cell Ablation on 3D Prostate Cancer Models

Omer Aydin

Department of Biomedical Engineering, University of Michigan

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Focal prostate cancer therapy is an approach that successfully eradicated the single tumor lesion. However, the focal therapy approaches have limitations on high-volume and multi-modal tumor lesions, and the success of focal prostate cancer therapy depends on the ability to selectively ablate cancer lesions. To address current therapeutic limitations, we have developed nanodroplets (average diameter<500nm) encapsulating perfluorocarbons (PFC), which can rapidly expand reaching >500µm in <1µsecond when exposed to therapeutic ultrasound before they collapse, which proved to mechanically fractionate neighboring cells with the significantly reduced cavitation threshold. To test the tumor ablation efficiency of the different PFCs (PFP or PFH)-encapsulated nanodroplets, we developed 3D prostate cancer spheroids from PC-3 and C4-2B cancer cells with using aqueous-two-phase-system (ATPS). First the spheroids were treated w/o PFP/PFH-loaded nanodroplets in the tube filling with PBS under low-pressure ultrasound signal (10 MPa) with the control of no ND and US. Afterwards, resazurin viability assay was employed. Based on the results we did not observe any significant ablation with only low-pressure ultrasound comparing to the control for both 3D models. However, once NDs were inserted to the tube upon exposure to 1-cycle of histotripsy (9.0 MPa) with the pulse repetition frequency of 500 kHz, more than 60% of the cells of both PC-3 and C4-2B spheroids were killed with PFP/PFH loaded-nanodroplets. Further, we developed agarose 3D tumor phantom model that mimicked the cells inside a tissue extracellular-matrix. The applied treatment groups were no ND with low-pressure (13 MPa), no ND with high-pressure (28 MPa), with PFP-loaded NDs with low-pressure (13 MPa), and with PFH-loaded NDs with low-pressure(13 MPa). During the treatments such high-pressure and low-pressure with nanodroplets, cavitation bubbles were observed at the transducer focus and cells were observed to be mechanically ruptured. After the treatments, the ablated area of the spheroids was calculated. No nanodroplets low-pressure could ablate less than 20% area for both cell lines. However, no nanodroplets with high-pressure ablated around 80% of the spheroids. Whereas, with low-pressure, PFP-nanodroplets destroyed 40% of the spheroids, and PFH-nanodroplets could ablate almost 80% of the spheroids. These results indicate PFC-loaded nanodroplets significantly reduce the histotripsy threshold, and PFH-loaded nanodroplets with low-pressure can destroy the cells as efficient as high-pressure.

Funding: OA is supported by the Republic of Turkey the Ministry of National Education (1416).
Advances in biomaterials science and engineering are crucial to solving complex medical problems that involve the replacement, repair, or regeneration of tissues and organs. Our laboratory pioneered the development and applications of citrate-based macromolecules (CBMs). CBMs can be engineered to exhibit physical, chemical, and biological functionalities that are suitable to solving a variety of medical problems and treating disease conditions in the circulatory, musculoskeletal, renal, integumentary (skin), and endocrine systems. I will discuss the properties of CBMs and fundamental design strategies that render them a powerful tool for cell delivery, wound healing, and regenerative engineering applications.
New materials with tailored structural and functional characteristics can advance the ways medical treatments are delivered in combating diseases and repairing damaged tissues. This lecture discusses two examples of in the development of polymeric nanomaterials to improve gene medicine delivery and enhance tissue regeneration. The biggest barrier to the realization of the therapeutic potential of gene medicine remains the efficacious and safe delivery system. Dr. Mao’s research uncovers materials engineering approaches that allows for exquisite control of biophysical properties of DNA nanoparticles that closely mimic that of natural viruses. These advances open up new avenues for governing the transport properties of therapeutic nanoparticles and enhancing delivery efficiency of gene medicine to the target tissue and organs. The second biomaterials engineering application is directed towards generating artificial extracellular matrices that can regulate cell morphology, migration, organization and tissue formation. Dr. Mao’s team develops an array of nanofiber materials with tailored structures and physical and biochemical characteristics that aid specific cellular functions, including expanding blood stem cells to support bone marrow transplantation and generate new vascular networks, deriving neural cell types to regenerate peripheral nerves and brain tissue, and facilitating soft tissue regeneration to repair traumatic injuries and tissue loss.
Engineering hydrogels for guiding cell decision making

Professor Kristopher A. Kilian

Department of Materials Science and Engineering, Department of Bioengineering, Micro and Nanotechnology Laboratory, Institute for Genomic Biology
University of Illinois at Urbana-Champaign
kakilian@illinois.edu

Cell lineage determination is no longer viewed as a hard-wired process and there are now several examples of dynamic differentiation (programming), de-differentiation and trans-differentiation (re-programming) events in mammalian biology. My lab is interested in how the properties of the cell and tissue microenvironment guides these processes and have developed a suite of engineered extracellular matrices to probe the biophysical and biochemical basis underlying cell programming and re-programming. In this talk I will show how engineered model systems—that better recapitulate in vivo biology than tissue culture plates—can be leveraged to explore how cells receive and integrate signals to specify lineage.

First, I will show how micropatterned hydrogels that control tissue geometry can rewire cell multipotency in cells derived from normal tissue and tumor tissue. Next, I will demonstrate a dynamic magnetically-tunable hydrogel that can stiffen in response to permanent magnets to direct dynamic modulation of stem cell activity. Finally I will show how controlling flow rates in a simple hydrogel extrusion device can be used to pattern cells in 3D architectures for exploring heterotypic cell signaling. These and other hydrogel-based model systems are changing the way in which fundamental biological questions can be probed, which we hope will lead to advances in drug development, engineered tissues, and cell-based therapies.
Macromolecular Engineering by Taming Free Radicals

*Professor Krzysztof Matyjaszewski*

Center for Macromolecular Engineering, Department of Chemistry, Carnegie Mellon University  
km3b@andrew.cmu.edu

Recent years witnessed tremendous progress in various controlled radical polymerization procedures. They employ a dynamic equilibrium between growing free radicals and dormant species. This process enables taming uncontrolled free radical behavior by inserting a dormancy periods of a few seconds or minutes after ca 1 ms activity. Such an intermittent activation route extends life of propagating chains from ca. 1 s to several hours and days. It also permits precise synthesis of macromolecules with complex architecture from small functional molecules as building blocks. Some examples of new initiating and catalytic systems used at ppm amounts for ATRP (atom transfer radical polymerization) will be presented. They open avenues to new block, gradient, graft, star, brush and (hyper)branched functional (co)polymers that find applications as various new advanced functional nanostructured materials.
Speaker CVs
Biographical Sketch

Arthur J. Coury

Art Coury holds a B.S. degree in chemistry from the University of Delaware (1962), a Ph.D. in organic chemistry (1965) and an M.B.A. (1980) from the University of Minnesota. His industrial career included positions as: Senior Research Chemist at General Mills, Inc. (1965-1976), Director, Polymer Technology and Research Fellow at Medtronic, Inc. (1976-1993), Vice President, Research and Chief Scientific Officer at Focal, Inc. (1993-2000), and Vice President, Biomaterials Research at Genzyme Corporation (2000-June, 2008). He currently is a consultant and academic professor. His career focus has been polymeric biomaterials for medical products such as implantable electronic devices, hydrogel-based devices and drug delivery systems.

He holds over fifty distinct patents and has published and presented widely in his field. His prior or current academic service has included adjunct or affiliate appointments at the University of Minnesota, the Harvard-MIT Graduate Program in Health Sciences and Technology, the University of Cape Town, South Africa, the University of Trento, Italy, Sichuan University, China and Northeastern University. His professional service has included: Chair, Minnesota Section, American Chemical Society (1989-1990); President, Society for Biomaterials, USA (1999-2000); President, American Institute for Medical and Biological Engineering (AIMBE) (2003-2004) and membership on a number of university, professional society and corporate advisory boards.

His recent recognitions have included the delivery of distinguished lectureships, receipt of the 2007 Innovation and Technology Development Award of the Society for Biomaterials, being named as one of “100 Notable People in the Medical Device Industry” by MD&DI magazine, 2008, induction into the National Academy of Engineering, USA, 2009, recognition on the University of Delaware alumni “Wall of Fame,” 2010, “The Man, the Myth, the Materials,” a symposium in honor of Art Coury’s 70th birthday, 2010, induction as an American Chemical Society Fellow, 2011, recipient of the Society for Biomaterials Founders’ Award, 2012 and its C. William Hall Award, 2013, of the AIMBE Pierre Galletti award for 2012, of the University of Minnesota Outstanding Alumni Award for 2013, appointment as Honorary Professor, Sichuan University, Chengdu, China (2013) and as University Distinguished Professor, Northeastern University (2014).
Biographical Sketch

Tatiana K. Bronich
Parke-Davis Professor, Department of Pharmaceutical Sciences, University of Nebraska Medical Center 985830 Nebraska Medical Center, Omaha, NE 6198-5830; Tel: (402) 559-9351; Fax: (402) 559-9365; E-mail: tbronich@unmc.edu

Professional Preparation
1979 M.S. in Chemistry, Moscow State University, Russia
1986 Ph.D. in Polymer Chemistry, Moscow State University, Russia

Appointments
2012- Director, NIH COBRE Nebraska Center for Nanomedicine, UNMC
2012- Parke-Davis Professor of Pharmaceutical Sciences, College of Pharmacy, UNMC
2010 Professor, College of Pharmacy, UNMC
2007 Co-Director, Center for Drug Delivery and Nanomedicine, UNMC
1997 Research Assistant then Associate Professor, College of Pharmacy, UNMC
1995 Research Associate, College of Pharmacy, University of Nebraska Medical Center, NE
1989 Research Fellow, Department of Polymer Sciences, Moscow State University
1985 Research Fellow, A.N. Nesmeyanov Institute of Elementoorganic Compounds, Russian Academy of Sciences.

Research interests
Dr. Bronich research is at the interfaces of polymer, colloidal and life sciences. Major scientific contributions are in the areas of synthetic and biological macromolecules, polymer micelles and complexes, and drug delivery systems. Of special interest is the design and study of novel types of bio-functional nanostructures utilizing a combination of supramolecular assembly and covalent chemical reactions. Detailed examination of the physical properties of these nanostructures and their subsequent physical and chemical manipulation is allowing for their development in areas as broad as drug delivery and molecular imaging. These systems are also of great fundamental importance as models of biological systems formed as a result of self-assembly processes. In addition, her recent work has expanded to include the application of these amphiphilic block copolymers and block ionomer complexes in drug delivery to treat cancer and infectious diseases. She has more than 100 publications and patents to her name.

Dr. Bronich is an established, NIH and Department of Defense-funded investigator with considerable peer-review experience. She has been serving as a chartered member of the NIH Study Section for Biomaterials and Biointerfaces (BMBI) since 2010 and has served on several other NIH grant review panels including Gene and Drug Delivery Systems, Nanotechnology, Developmental Therapeutics and others. Notably, Dr. Bronich has also been a reviewer of numerous grants for the NSF Directorate of Engineering and other national and international funding agencies.
Si-Eun Kim
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Education
2011-present Ph.D. candidate, Macromolecular Science & Engineering Department
Case Western Reserve University, OH, U.S.A
Academic Advisor: Jonathan K. Pokorski

Fall 2008 M.S. Polymer Science & Engineering, Polymer Science & Engineering
SungkyunKwan University, South Korea
Academic Advisor: Dr. Jaedo Nam, Co-Advisor Dr. Lyongsun Pu

Spring 2006 B.S. Polymer Science & Engineering, Polymer Science & Engineering
SungkyunKwan University, South Korea
Undergraduate Research Advisor: Dr. Jungho Aan

Publications
1 Si-Eun Kim, Emily C. Harker, Abigail A. Advincula, Jonathan K. Pokorski*, “Multifunctional and Spatially Controlled Bioconjugation to Melt Coextruded Nanofibers”, Polymer Chemistry, 2015, DOI: 10.1039/C5PY00282F (Highlighted in the Emerging Investigators Special Themed Issue)

2 Sung Nam Kang, Si-Eun Kim, Jiyeon Choi, Kwidoek Parke, Jae Hwan Goo, Doo Sun Sim, Young Joon Hong, Ju Han Kim, Yoon Ki Joung, Jay Lee, Myung Ho Jeong, Dong Keun Han “Comparison of phytoncide with sirolimus as a novel drug candidate for drug-eluting stent” Biomaterials, 2015, 44, 1–10

3 Si-Eun Kim, Emily C. Harker, Al C. De Leon, Rigoberto C. Advincula, Jonathan K. Pokorski*, “Coextruded, aligned, and gradient-modified poly(ε-caprolactone) fibers as platforms for neural growth”, Biomacromolecules, 2015, ASAP


5 Pyoung-Chan Lee, Sieun Kim, Yong-Soo Oh, Lyongsun Pu and Jae-Do Nam*, “Tunable surface hardness and dielectric constant of SiCxOy thin film converted from solution-processed organosilicon compound” J. Mater. Sci., 2012, 47, 4540-4545.


7 Sieun Kim, Bong Soo Lee, Kwideok Park, Dong Keun Han “Study on the behavior and control of paclitaxel release from various biodegradable polymers for DES application” Polymer (Korea), 2010, 34, 173-178.

Patent
“Polymer Nanofiber Scaffolds and Uses Thereof” Inventors: Jonathan Pokorski, Eric Baer, Si-Eun Kim, Jia Wang (Application #: PCT/US2015/015243)

Award
2015 Baxter’s Young Investigator Award 1st tier
OMER AYDIN  
e-mail: biomer@umich.edu

EDUCATION

**Ph.D.: 2010...** The University of Michigan (ANN ARBOR, USA), Department of Biomedical Engineering  
**M.Sc.: 2007- 2009** Yeditepe University (ISTANBUL, TURKEY), Department of Genetics & Bioengineering  
**B.Sc.: 2003- 2007** Baskent University (ANKARA, TURKEY), Department of Biomedical Engineering

PUBLICATIONS


INVITED TALKS: Case Western Reverse University, Department of Biomedical Engineering, Department Seminar, “Nanomedicine Solutions on Focal and Metastatic Prostate Cancer Treatment”, March 30, 2015.

RESEARCH INTEREST: Design and synthesis of "smart" particles (pH sensitive and thermoresponse), Development of Targeted Nanoparticles for Ultrasound Imaging/Therapy, gas-encapsulated nanodroplets, Controlled Polymerizations Methods (ATRP), Click Chemistry, Surface modification, Development of PDMS surfaces and novel materials for diagnostics and biosensors applications, Synthesis and modification of gold and silver nanoparticles, Raman Spectroscopy, Surface Enhanced Raman Scattering (SERS).

AWARDS, SCHOLARSHIPS, HONORS

1. Travel funds from the University of Michigan BMES Chapter for BMES Annual Meeting, 2015.  
2. The Travel Grant of Rackham Graduate School, nanoDDS 13th International Nanomedicine & Drug Delivery Symposium.  
4. Rackham Graduate Student Research Grant, 2015.  
5. The Travel Grant of Rackham Graduate School, BMES Cell & Molecular Bioengineering Meeting, 2015.  
7. 2009-2015, Turkish Republic, National Education Assembly's Ph.D. Scholarship for USA.
**Biographical Sketch**

**Guillermo Ameer**

2001- Professor, Department of Biomedical Engineering, Northwestern University
Professor, Feinberg School of Medicine, Northwestern University

Dr. Ameer is a professor in the Biomedical Engineering Department at the McCormick School of Engineering and the Department of Surgery at the Feinberg School of Medicine, Northwestern University. He is also a resident faculty at the Simpson-Querrey Institute and a member of the Chemistry of Life Processes Institute. His research interests include biomaterials, vascular and orthopaedic tissue engineering, regenerative engineering, controlled drug delivery and bio/nanotechnology for improved therapeutics and diagnostics. Specifically, Dr. Ameer’s laboratory pioneered the development of citric acid-based polyesters, referred to as polydiolcitrates.

He has co-authored over 200 peer-reviewed journal publications and conference abstracts, several book chapters, and over 33 patents issued and pending in 8 countries, several of which have been licensed. Dr. Ameer has received numerous awards, including election to Technology Review Magazine's top 100 Young Innovators in the world, the NSF CAREER award, and the American Heart Association's Established Investigator Award.

He has served on several national and international scientific review committees for funding research. He was elected Fellow of the American Institute of Medical and Biological Engineering and of the Biomedical Engineering Society. He has served as a permanent member of the Musculoskeletal Tissue Engineering study section of the National Institutes of Health. Dr Ameer is an associate editor of the journal Regenerative Engineering and Translational Medicine and he is on the editorial boards of the Journal of Biomedical Materials Research: Part A and Organogenesis. He is a member of the scientific advisory board of Acuitive Technologies, LLC and was the co-founder of several medical device companies in the areas of dialysis, vascular surgery, and orthopedic surgery.
Hai-Quan Mao, Ph.D.  

PROFESSIONAL PREPARATION:

Wuhan University (P. R. China)  Chemistry  B.S.  1988
Wuhan University (P. R. China)  Polymer Chemistry  Ph.D.  1993
Johns Hopkins University  Biomedical Engineering  Postdoctoral fellow  1995-1999

APPOINTMENTS:

2003 – present  Professor (2013– ), Associate Professor (2009–13), Assistant Professor (2003–09), Department of Materials Science and Engineering, Whiting School of Engineering

1999 – 2003  Co-Principal Investigator, Johns Hopkins in Singapore

1999 – present  Institute for NanoBioTechnology, Johns Hopkins University

SELECTED EXPERIENCE AND PROFESSIONAL MEMBERSHIPS:


HONORS AND AWARDS:

Cygnus Graduate Student Award for Outstanding Delivery Work (1997), Capsugel Award for Outstanding Research in Innovative Aspects of Controlled Drug Release (1998, 2001), Controlled Release Society; Young Investigator Award, National University of Singapore (2002); Faculty Early Career Award, National Science Foundation (2008); Excellence in Teaching Award, Johns Hopkins University Alumni Association (2008); A. David Mazzzone-PCF Challenge Award (with Martin Pomper), Prostate Cancer Foundation (2012); Fellow, Royal Society of Chemistry (2014)

PUBLICATIONS AND PATENTS:

110 Peer-reviewed journal publications; 18 issued patents; Total citations: 8300; h-index: 45.

RESEARCH INTEREST: (a) Nanoparticle-mediated delivery of nucleic acid therapeutics; (b) Packaging plasmids into virus-mimicking micelles with tunable shape and size; (c) Nanofiber matrices for stem cell expansion and differentiation; (d) Assembling aligned hydrogel microfibers for tissue engineering applications

SELECTED PUBLICATIONS:

• Christopherson GT, Song H, Mao HQ. The influence of fiber diameter of electrospun substrates on neural stem cell differentiation and proliferation. Biomaterials. 30(4): 556-64 (2009).

EDUCATION

Doctor of Philosophy in Chemistry
University of New South Wales, Sydney, Australia, 8/2007

Master of Science in Chemistry
Organic Chemistry and Chemical Biology
University of Washington, Seattle, Washington, 6/2003

Bachelor of Science in Chemistry
University of Washington, Seattle, Washington, 6/1999

PROFESSIONAL EXPERIENCE

Affiliate Faculty, Department of Bioengineering, University of Illinois at Urbana-Champaign, 10/2011 – present

Affiliate Faculty, Institute for Genomic Biology, Regenerative Biology and Tissue Engineering (RBTE) Theme, University of Illinois at Urbana-Champaign, 10/2011 – present

Assistant Professor, Department of Materials Science and Engineering, Micro and NanoTechnology Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois, 8/2011 – present


Graduate Student, School of Chemistry, Supervisor: Justin Gooding, University of New South Wales, Sydney, Australia, 7/2004 – 8/2007


HONORS & AWARDS

2015 NSF CAREER Award, National Science Foundation (CBET BBE/DMR BMAT)
2015 List of Teachers Ranked as Excellent, UIUC
2014 Kavli Fellow, 19th German-American Frontiers of Science Symposium
2013 Engineering Council Award for Excellence in Advising, College of Engineering, UIUC
2011 Australian Research Council Eureka Prize Finalist for Excellence in Research by an Interdisciplinary Team
2008 Ruth L. Kirschstein National Research Service Award (NRSA); NIGMS, NIH
2008 Cornforth Medal, “Best PhD thesis submitted in a branch of chemistry, chemical science or chemical technology in Australia”, The Royal Australian Chemical Institute
2006 Poster winner, The International Conference on Nanoscience and Nanotechnology, Brisbane, Australia
1992 Study and Research Grant, the Environmental Management Pre-college Analytical Chemistry Program (EMPAC), University of Washington
Krzysztof Matyjaszewski

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Address

Polytechnic University of Lodz, Poland, Habilitation, 1985
Polish Academy of Sciences, Ph.D., 1976 (Prof. S. Penczek, Thesis Advisor)
Technical University, Moscow, B.S./M.S., 1972

Experience

04.2004 present University Professor, Carnegie Mellon University
06.1998 present J.C. Warner Professor of Natural Sciences, Carnegie Mellon University
07.1994 06.1998 Head, Chemistry Department, Carnegie Mellon University
10.1985 06.1998 Assistant, Associate and Full Professor, Carnegie Mellon University
04.1984 10.1985 Research Associate, CNRS and Invited Professor, University of Paris, France
03.1978 04.1984 Research Associate, Polish Academy of Sciences
03.1977 03.1978 Post-doctoral Fellow, University of Florida

Honors and Awards

2015: The Dreyfus Prize in the Chemical Sciences, Charles Overberger Award (ACS), Honorary Degree (Doctorate Honoris Causa) Technion, Haifa, Israel; 2014: Fellow, National Academy of Inventors; National Institute of Materials Science (NIMS, Japan), Award 2013: Doctorate Honoris Causa, University of Paris, Sorbonne, France; Inaugural AkzoNobel North American Science Award (ACS); Doctorate Honoris Causa, Pusan National University, South Korea, Madison Marshall Award (ACS, Alabama Section); 2012: Dannie-Heineman Prize, Goettingen Academy of Sciences; Maria Sklodowska-Curie Medal, Polish Chemical Society; Société Chimique de France Prize; Foreign Member of Russian Academy of Sciences; Marie Sklodowska-Curie Science Medal, Pilsudski Institute of America; Honorary Fellow of Chinese Chemical Society; 2011: Wolf Prize in Chemistry, Israel; Applied Polymer Science Award (ACS), Carnegie Science Award in Advanced Materials; Japanese Society of Polymer Science Award, Hermann Mark Award (ACS); 2010: ACS, Fellow; ACS Polymer Division, Fellow; Gutenberg Lecture Award, University of Mainz, Germany; Doctorate Honoris Causa 1’Institut Polytechnique, Toulouse, France; 2009: Presidential Green Chemistry Challenge Award; 2008: Doctorate Honoris Causa University of Athens, Greece; 2007: Hermann F. Mark Senior Scholar Award (ACS); Doctorate Honoris Causa Lodz Polytechnic, Poland; 2006: Member of US National Academy of Engineering; Doctorate Honoris Causa Russian Academy of Sciences; 2005: UK Macro Medal; 2004: Annual Prize of the Foundation of Polish Science; Foreign Member of Polish Academy of Sciences; Cooperative Research Award in Polymer Science (ACS); 2002: Polymer Chemistry Award (ACS); Doctorate Honoris Causa University of Ghent, Belgium; 2001: Pittsburgh Award (ACS); Polymeric Materials Science and Engineering Fellow (ACS); 1999: Humboldt Award for Senior US Scientists; 1998: Elf Chair of French Academy of Sciences; 1995: Carl S. Marvel - Creative Polymer Chemistry Award (ACS); 1989: Award of Presidential Young Investigator (NSF); 1981: Award of Polish Academy of Sciences; 1980: Award of Polish Chemical Society

-Adjunct Professor, Polish Academy of Sciences, Lodz (2000- present); Adjunct Professor, Department of Chemical and Petroleum Engineering, University of Pittsburgh (2000- present), Adjunct Professor: Department of Chemical Engineering, Carnegie Mellon University (2007- present); Department of Materials Science, Carnegie Mellon University (2007- present);

-Affiliate Member- Faculty of the McGowan Institute for Regenerative Medicine, University of Pittsburgh (2009-present)

-Director: ATRP and CRP Consortia (1996-…); Director, Center for Macromolecular Engineering (CMU, 1998-…)


-Editor: "Progress in Polymer Science"; “Central European Journal of Chemistry”; Member of Editorial Boards of 14 journals - IUPAC: Fellow (2002-); Corresponding Member of IUPAC Commission on Polymer Nomenclature -Polymer Chemistry Division, ACS: Past Chair of the Polymer Curriculum Development Award Committee (1987-2001); Member of Program Committee and Chair of International Committee.

-Pacific Polymer Federation: President 2013-2015

-Coauthored/editing: 17 books, 83 book chapters and >890 peer-reviewed scientific papers; 51 US and 143 international patents and 36 pending US patent applications. Total citation number exceeds 71,000, ranking among top 10 chemists world-wide in 2004-2015 with h-index 133. Current group consists of 14 graduate students and 6 postdoctoral fellows.

-ATRP/CRP Consortia – Over 50 multinational chemical companies from US, Europe, Japan and other countries have been members of the Consortia. 16 commercial licenses signed for ATRP technology and production of polymeric materials in US, Japan, Europe started in 2004.

Research Interests: 1. Well-defined macromolecules via living and controlled polymerizations. 2. Radical, cationic, and anionic polymerization of alkenes and heterocyclics. 3. Block, graft and gradient copolymers. 4. Control of chain microstructure and topology. 5. Functional polymers and telechelics; 6. Homogeneous and heterogeneous catalysis; 7. Well-defined polymers and hybrids for optoelectronic and biomedical applications; 8. “Green” chemistry
Posters
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<td>Dowon Ahn</td>
<td>University of Michigan</td>
<td><em>Hexaarylbiimidazoles: New class of dynamic covalent bonds and its utilization</em></td>
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<tr>
<td>Jin Arakida</td>
<td>Nara Institute of Science and Technology</td>
<td><em>Design and evaluation of membrane-active polymers to form lipid bilayer nanodisc</em></td>
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<td>Omer Aydin</td>
<td>University of Michigan</td>
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