

## PDA Report / Fall 2016

### Tomoko Fujiwara, Department of Chemistry

#### 1. Research conducted (e.g., archival work, field research)

For the PDA opportunity in Fall 2016, I have focused on developing my research techniques and knowledge of material evaluation on my two major research projects.

- 1) Visited UT-Knoxville for 2 weeks in Oct 2016 to discuss for two existing projects, "Development of Proton Exchange Membranes for Vanadium Redox Flow Batteries" and "Polystyrene Based Anion Exchange Membranes for Alkaline Fuel Cells", and to learn engineering evaluation methods of our samples in Zawodzinski's lab. I have also held short workshop style lecture series for graduate and undergraduate students at UTK. These experiences were very important and effective for my research group to develop better chemistry systems as well as for the collaborator's students to understand our materials.
- 2) Visited collaborator, Dr. Merkel's lab at Wayne State University for the gene delivery system workshop. I spent two days in the lab for biological evaluation of gene carriers and one day for discussion of co-publication drafts and future research direction.

#### 2. Manuscripts written (e.g., journal articles, book chapters, book proposals)

##### Journal articles

- 1) Mohammadi, M.; Li, Y.; Abebe, D.G.; Xie, Y.; Kandil, R.; Kraus, T.; Gomez-Lopez, N.; Fujiwara, T.; Merkel, O.M. "Folate Receptor Targeted Three-Layered Micelles and Hydrogels for Gene Delivery to Activated Macrophages" *Journal of Controlled Release*, **2016**; *244*, 269-279.
- 2) Su, H.; Liu, K-Y.; Karydis, A.; Abebe, D. G.; Wu, C.; Anderson, K.; Ghadri, N.; Adatrow, P.; Fujiwara, T.; Bumgardner, J. "In vitro and in vivo evaluations of a novel post-electrospinning treatment to improve the fibrous structure of chitosan membranes for guided bone regeneration" *Biomedical Materials*, **2017**; *12*, 015003.
- 3) Gindt, B. P.; Tang, Z. J.; Watkins, D. L.; Abebe, D. G.; Seo, S.; Tuli, S.; Ghassemi, H.; Zawodzinski T. A.; Fujiwara T. "Effects of Sulfonated Side Chains Used in Polysulfone Based PEMs for VRFB Separator" *Journal of Membrane Science*, **2017**; *532*, 58-67.
- 4) McGraw, G. S.; Jennings, J. A.; Fujiwara, T.; Masters, E.; Haggard, W. O.; Bumgardner, J. "Chitosan Microspheres Cross-linked with Glyoxal for the Local Delivery of Antibiotics" *Journal of Polymer Materials*, **2017**; *34(1)*, Jan-March.
- 5) Mohapatra, A.; Harris, M. A.; LeVine, D.; Ghimire, M.; Jennings, J. A.; Morshed, B. I.; Haggard, W. O.; Bumgardner, J. D.; Mishra, S. R.; Fujiwara, T. "Magnetic Stimulus Responsive Vancomycin DDS Based on Chitosan Microbeads Embedded with Magnetic Nanoparticles" *Transactions on Biomedical Engineering*, submitted.
- 6) Tuli, S. K.; Roy, A. L.; Elgammal, R. A.; Zawodzinski, T. A.; Fujiwara, T. "Polystyrene Based Anion Exchange Membranes via Click Chemistry: Improved Properties and AEM Performance" *Polymer*, submitted.

##### Review articles

- 1) Kandil, R.; Mohammadi, M.; Abebe, D.G.; Merkel, O.M.; Fujiwara, T. "Polymeric Micelles, Nanogels, and Hydrogels for Targeted Gene Delivery Systems" *Progress in Polymer Science* (invited peer-reviewed review), to be submitted shortly.

##### Book chapters

1) Fukushima, K.; Fujiwara, T. "New Routes to Tailor-Made Polyesters" In *Synthesis and Characterization of Biorelated Polymers* ; Scholz, C., Ed; John Wiley & Sons, Inc.: NJ, 2017 in print.

#### Conference proceedings

1) Mohapatra, A.; Harris, M. A.; Ghimire, M.; Jennings, J. A.; Morshed, B. I.; Haggard, W. O.; Bumgardner, J. D.; Mishra, S. R.; Fujiwara, T. "Chitosan Microbeads with MNP on Printed Electrodes for Electric Stimulus Responsive Drug Delivery" *2017 IEEE International Symposium on Medical Measurements and Applications (MeMeA)*, accepted.

#### 3. Grant proposals (written or submitted)

##### Submitted

- 1) NSF PD06-7623 [Fujiwara] 7/1/2017 - 6/30/2020 (PI), \$538,002  
Polycomplex Multilayered Micelles and Hydrogels for Efficient Drug and Gene Delivery Systems (declined)
- 2) NSF PD16-568 [Zawodzinski] 7/1/2017 - 6/30/2022 (Co-PI), \$1,800,000  
CCI: Controlling Ion and Solvent Behavior in Membranes, (declined)
- 3) APS General User Proposal Tunable Nanochannels and their effect on membrane separators; Argonne National Laboratory; \$0; 2017, (beamtime granted)
- 4) NIH 1R01DE026759-01 [Bumgardner] 4/1/2017 - 3/31/2022 (Co-Investigator), \$2,200K  
Chitosan Guided Bone Regeneration Membranes for Dual Local Delivery of Simvastatin and Raspberry Ketone (funded)

##### Preparation

- 1) NIH R15 [Fujiwara] (PI)  
In-situ forming gel devices as local depot therapeutic for Rheumatoid Arthritis

#### 4. Papers presented at conferences

- 1) "Biodegradable Three-Layered Micelle and its hydrogel for Safe and Efficient Gene Delivery System" *International Symposium on Advances in Sustainable Polymers (ASP-16)*, Kyoto, Japan, Aug 2016

#### 5. Talks given to professional audiences (e.g., universities, businesses)

- 1) University of Tennessee Knoxville, "Designing smart polymeric membranes for energy storage devices and beyond" Oct 2016.

#### 6. Other collaborative activities

I have initiated research projects of new direction during my PDA.

- 1) "Direct Inkjet Printable Low-voltage Active Flexible Electronic Component Fabrication" collaborating with Dr. Bashir Morshed in Electrical and Computer Engineering. We will develop 3D printing, "body-worn" electronic circuit that serves as a sensor for multiple stimuli from human body. My group develops polymeric conductive materials. This project was recently funded by internal team grant for 2 years.
- 2) "Smart Hydrogels for Ankle Stability and Mobility" collaborating with Dr. Douglas Powell in School of Health Studies. We will develop stimuli-responsive or programable materials to use for a sock or patch for a variety of needs.

Overall, my activities in Fall 2016 were very productive and created multiple seeds for external funding opportunities.