

- 2010 Travel grant for the Northeast Regional Undergraduate and Graduate Student Sigma XI Poster Conference in New Haven, CT.
- 2009 Travel grant for the Annual Biomedical Research Conference for Minority Students in Phoenix, Arizona.
- 2009 Travel grant for the Eastern Analytical Symposium and Exposition in Somerset, New Jersey.
- 2008-2010 CSTEP support for undergraduate research under the direction of Dr. Duncan Quarless.

PUBLICATIONS

- Ennist, J.H.; Gobrogge, E.A.; Schlick, K. H.; Walker, R.A.; Cloninger, M.J. "Cyclodextrin-functionalized Chromatographic Materials Tailored for Reversible Adsorption." 2014
- Ennist, J.H., Cloninger, M.J. "The synthesis of *N*-acetyllactosamine functionalized dendrimers and their role in galectin-3 mediated cell aggregation studies." Manuscript in preparation.
- Ennist, J.H., Cloninger, M.J. "The synthesis and catalytic efficiency of chiral dendronized surfaces." Manuscript in preparation.
- Ennist, J.H.; Walker, R.A.; Cloninger, M.J. "Tunable, pH respondent surfaces designed for reversible adsorption of targeted chlorophenols in bulk aqueous solutions." Manuscript in preparation.

PRESENTATIONS

- 2016 "The Synthesis of *N*-Acetyllactosamine Functionalized Dendrimers" at the International Carbohydrate Symposium in New Orleans, LA
- 2010 "Conformational Factors of Sulfur-centered Reactivity in Model Nitrogen-Sulfur Mixed Ligand Complexes of Zinc" at Northeast Regional Undergraduate and Graduate Student Sigma XI Poster Conference in New Haven, CT and Statewide Student Conference for the CSTEP in Bolton Landing, NY.



Department of Chemistry and Biochemistry

Doctor of Philosophy
in Chemistry

DISSERTATION DEFENSE

Ms. Jessica H. Ennist

B.S. S.U.N.Y. at Old Westbury, Old Westbury, NY (2010)

Thursday, June 1, 2017 – 9 am
Byker Auditorium

Department of Chemistry and Biochemistry

"The synthesis of *N*-acetyllactosamine functionalized dendrimers, and the functionalization of silica surfaces using tunable dendrons and β -cyclodextrins."

Graduate Committee

- Dr. Mary Cloninger (Research Advisor)
Dr. Robert Walker (Chemistry)
Dr. Tom Livinghouse (Chemistry)
Dr. Brian Bothner (Chemistry)

ABSTRACT

Galectin-3 is a β -galactoside binding protein which is found in many healthy cells. In cancer, the galectin-3/tumor-associated Thomsen-Friedenreich antigen (TF antigen) interaction has been implicated in heterotypic and homotypic cellular adhesion and apoptotic signaling pathways. However, a stronger mechanistic understanding of the role of galectin-3 in these processes is needed. *N*-acetyllactosamine (LacNAc) is a non-native ligand for galectin-3 which binds with affinity comparable to that of TF antigen and is therefore an important ligand to study galectin-3 mediated processes.

To study galectin-3 mediated homotypic cellular aggregation, four generations of polyamidoamine (PAMAM) dendrimers were functionalized with *N*-acetyllactosamine using a four-step chemoenzymatic route. The enzymatic step controlled the regiochemistry of the galactose addition to *N*-acetylglucosamine functionalized dendrimers using a recombinant β -1,4-Galactosyltransferase-/UDP-4'-Gal Epimerase Fusion Protein (IgtB-galE). Homotypic cellular aggregation, which is promoted by the presence of galectin-3 as it binds to glycosides at the cell surface, was studied using HT-1080 fibrosarcoma, A-549 lung carcinoma, and DU-145 prostate cancer cell lines. In the presence of small LacNAc functionalized PAMAM dendrimers, galectin-3 induced cancer cellular aggregation was inhibited. However, the larger glycodendrimers induced homotypic cellular aggregation.

Additionally, novel poly(aryl ether) dendronized silica surfaces designed for reversible adsorption of targeted analytes were synthesized, and characterization using X-ray Photoelectron Spectroscopy (XPS) was performed. Using a Cu(I) mediated cycloaddition "click" reaction, β -cyclodextrin was appended to dendronized surfaces via triazole formation and also to a non-dendronized surface for comparison purposes. First generation G(1) dendrons have more than 6 times greater capacity to adsorb targeted analytes than slides functionalized with monomeric β -cyclodextrin and are 2 times greater than slides functionalized with larger generation dendrons. This study reported β -cyclodextrin functionalized surfaces can undergo a triggered release of the adsorbent, but otherwise retained the targeted analyte through multiple aqueous washes. Therefore, a new generation of G(1) dendronized surfaces capable of reversible adsorption were developed by heterogeneously appending sulfonic acid/pyridine end-groups. Auger Electron Spectroscopy (AES) was used to quantify the ratio of groups installed. Furthermore, G(1) dendronized surfaces were functionalized homogeneously with sulfonic acid and pyridine for comparison and with chiral amino acids for chiral recognition studies.

BIOGRAPHICAL NOTES

Academic Preparation:

- 2010 B.S. Biochemistry; SUNY College at Old Westbury, Old Westbury, NY.
Thesis: Conformational Factors of Sulfur-centered Reactivity in Model Nitrogen-Sulfur Mixed Ligand Complexes of Zinc.
Advisor: Dr. Duncan Quarless
- 2008 A.A. Math and Science; SUNY Ulster, Stone Ridge, NY.

Graduate Studies

Field of Study: Organic Chemistry

Courses

Physical Organic Chemistry
Organic Synthesis
Biomaterials
Reagent Chemistry
Biomaterials Chemistry
Genes and Cancer

Teaching and Outreach Activities

- 2011-2017 Organic Chemistry Lab TA, Montana State University
2010 General Chemistry Lab TA, Montana State University

Awards

- 2016 Travel grant from the Graduate School at Montana State University.
- 2010 Academic Achievement in Principles of Chemistry at Honors Convocation in SUNY Old Westbury.
- 2010 Outstanding Achievement in Undergraduate Chemistry at Honors Convocation in SUNY Old Westbury.
- 2010 Travel grant from the Louis Stokes Alliances for Minority Participation (LSAMP) to attend the AMP conference at Brookhaven National Laboratory in Upton, New York.
- 2010 CSTEP travel grant to attend the CSTEP conference in Bolton Landing, NY.
- 2010 1st place in Physical Chemistry for research in "Conformational Factors of Sulfur-centered Reactivity in Model Nitrogen-Sulfur Mixed Ligand Complexes of Zinc" at the Statewide Student Conference for the CSTEP in Bolton Landing, NY.