

PRESENTATIONS

David Skowron, Yuyuan Zhang, Ashley Beckstead, Jacob M. Remington, and Bern Kohler, "Time-resolved Fluorescence of Model DNA Oligonucleotides," oral presentation at the Optical Technology Center 2016 Annual Conference, Bozeman, MT. Oct. 4, 2016

David Skowron, Yuyuan Zhang, Ashley Beckstead, and Bern Kohler, "Sub-nanosecond Emission from AT DNA Oligonucleotides Compared with Time Resolved Absorption," poster presentation at the 63rd Pacific Conference on Spectroscopy and Dynamics, Pacific Grove, CA. Jan. 28 – 31, 2016

David Skowron and Bern Kohler, "Time Dependent Fluorescence of Model DNA Oligomers," poster presentation at the Optical Technology Center 2015 Annual Conference, Bozeman, MT. Sep. 15, 2015.



Department of Chemistry and Biochemistry

**Doctor of Philosophy
in Chemistry**

DISSERTATION DEFENSE

Mr. David J. Skowron

B.Sc. Christopher Newport University, Newport News, VA (2012)

Wednesday, May 10, 2017 – 1 pm

Byker Auditorium

Department of Chemistry and Biochemistry

**“Subnanosecond Emission from Model DNA Oligomers
Characterized through Time-Correlated Single Photon
Counting Spectroscopy”**

Graduate Committee

Dr. Bern Kohler (Research Advisor)
Dr. Rob Walker (Co-Chair, Chemistry)
Dr. Pat Callis (Chemistry)
Dr. Rufus Cone (Physics)

ABSTRACT

Exposure of DNA to UV radiation creates electronic excited states that can decay to mutagenic photoproducts. Excited states can return to the electron ground state through deactivation pathways, preventing photochemical damage. Much effort has been devoted to understanding these pathways over the last half century. Understanding has significantly advanced over the last decade through the applications of time-resolved techniques capable of picosecond and femtosecond time-resolution. While significant strides have been made towards understanding monomeric deactivation pathways, unraveling the complex photophysics of base multimers still presents a significant challenge. This report uses time-resolved fluorescence and ultrafast transient absorbance to analyze model DNA oligomers to understand how fundamental interactions between monomeric constituents influences the dynamics of base multimers. Model single- and double-stranded DNA oligomers were investigated using the time correlated single photon counting technique to address the uncertainty over how to compare results from time-resolved fluorescent and transient absorption techniques. Emission lifetimes ranging from 50 to 200 ps quantitatively agree with lifetimes measured from transient absorption experiments indicating emission observed on timescales greater than a few picoseconds is the result of excimer or charge recombination luminescence. In attempts to further characterize the time-resolved emission from model oligomers adenine oligomers consisting of 2 and 18 base constituents were examined in aqueous water and heavy water solutions. Differences in dynamics between the two oligomers revealed the average number of bases present within a stacked domain influence the dynamics of these systems. Lifetimes of the emission decays were assigned excimer-like states with various degrees of charge-transfer character. Finally, to further demonstrate the importance of base stacking domain length on the dynamics of these systems, time-resolved emission and absorption of the adenine dinucleotide and 18-mer were examined at temperatures ranging from 7 °C – 80 °C. It was observed that the kinetics between the oligomers was noticeably different at lower temperatures, but not at higher temperatures. It was concluded the domain length of the 18-mer was similar to the domain length of the dinucleotide at high temperatures, but not at low temperatures, demonstrating the domain length significant impacts the photophysics of DNA.

BIOGRAPHICAL NOTES

Academic Preparation:

2008-2012 Christopher Newport University, Newport News, VA (May 2012)
Bachelor of Science in Chemistry minor: Biology
Advisor: Dr. Timothy Smith

2010 Christopher Newport University
Undergraduate Research
Research: trace metal composition of flax seed through ICP-AES
Advisor: Dr. Tyler Sullens

2011 Christopher Newport University
Undergraduate Research
Research: Adsorption of polycyclic aromatic hydrocarbon self-aggregates on functionalized silica
Advisor: Dr. Timothy Smith

2012 Christopher Newport University
Undergraduate Research
Research: CHNOS analysis of crude oil fragments
Advisor: Dr. Geoffrey Klein

Graduate Studies

Field of Study: Physical Chemistry

Courses

Teaching and Outreach Activities

2012-2014	General Chemistry Lab TA, Montana State University
2014	General Chemistry Recitation TA, Montana State University
2015	General Chemistry Lab TA, Montana State University
2015	General Chemistry Recitation TA, Montana State University
2016	General Chemistry Lab TA, Montana State University
2016	Kinetics and Thermodynamics TA, Montana State University
2017	General Chemistry Lab TA, Montana State University
2017	Kinetics and Thermodynamics TA, Montana State University

PUBLICATIONS

Skowron, D. J.; Zhang, Y.; Beckstead, A. A.; Remington, J. M.; Strawn, M.; Kohler, B. "Subnanosecond Emission Dynamics of AT DNA Oligonucleotides." *Chemphyschem* 2016, 17, 3558