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Recommended Citation

University Relations, "Undergraduate research conducted by Debbie Schneiderman '11, Luverne, and Matthew Lovander '12, Willmar, published in leading chemistry journal" (2011). *Campus News Archive*. 782.

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Undergraduate research conducted by Debbie Schneiderman '11, Luverne, and Matthew Lovander '12, Willmar, published in leading chemistry journal

Summary: Working with Ted Pappenfus, associate professor of chemistry, the students created the first known redox polymer that conducts electrons and holes.

(February 3, 2011)-The research of Debbie Schneiderman '11, Luverne, and Matthew Lovander '12, Willmar, working with Ted Pappenfus, associate professor of chemistry, has been published in a special issue of a leading journal, Chemistry of Materials. Schneiderman and Lovander synthesized new organic molecules toward the development of materials with enhanced electronic properties. In doing so, they created the first known redox polymer that conducts electrons and holes—a significant discovery in organic materials research.

An international collaboration confirmed the success of the trio's research. In summer 2010, the materials they created in Morris were sent to the University of Málaga in Málaga, Spain, and to the Istituto CNR per l'Energetica e le Interfasi in Padova, Italy, to be further analyzed by scientists, highly regarded in their fields of study. The experimental and theoretical analyses performed in Europe provided valuable information and were crucial for the overall project.

Pappenfus shares that organic materials are a "hot area" for research because of the limitations of current products in terms of price and flexibility. Researchers are looking for better molecules to conduct electricity for a variety of electronic device applications, including LEDs, solar cells, and transistors. A new wave of electronics may be emerging soon, and Schneiderman and Lovander's research contributes a noteworthy step in that direction. As stated in the editorial in this issue of Chemistry of Materials, organic electronics is projected to become a \$30 billion industry in the United States by 2015.

Matt Lovander

Lovander first explored research opportunities at Morris with Pappenfus in the Introduction to Research course. He soon discovered that it was a good fit. "I really like working in the lab," he says. "I'm a 'hands on' person. Being part of something new is really cool. It opens your mind. You become not so scared to try something new. Confidence grows each time you have success. You have to accept failures, too. That's the real world. Then something works, and it overshadows all the failures. I'm thankful this project was offered to me."

Debbie Schneiderman

Schneiderman initially began researching with Pappenfus as a Morris Academic Partner conducting theoretical chemistry—on a computer. But she, too, has grown comfortable in the lab. "I like the synthetic chemistry lab now, she shares. And I understand, too, that I learn a lot when I fail. In fact, I get more determined. I participated in a National Science Foundation—Research Experiences for Undergraduates program at the University of Nebraska, Lincoln in biochemistry and microbiology. It was a good opportunity, but it made me realize how much I have come to enjoy synthetic chemistry and the lab. I've decided to apply to graduate school in organic chemistry."

The students will present their research, "Oligothiophene Tetracyanobutadienes: Alternative Donor-Acceptor

Architectures for Molecular and Polymeric Materials” as a poster presentation at the Spring National Meeting of the American Chemical Society in Anaheim, California, and at the Undergraduate Research Symposium to be held on the Morris campus on Saturday, April 16, 2011. The Chemistry of Materials article can be read [online](#).

Lovander and Pappenfus will continue to explore the chemistry of these new materials during summer 2011. The research is primarily funded through a grant from the University of Minnesota Initiative for Renewable Energy and the Environment (IREE).

Photos: Matthew Lovander '12, Willmar, and Debbie Schneiderman '11, Luverne

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