Medical Biology Major Combines Medicine with Research

Andrew Koch had a less-than-glamorous introduction to biology research at USD. While working on a project measuring the effects of pesticides on biodiversity, the medical biology major from Sioux Falls spent hours carefully plucking insects and other invertebrates out of samples of mud taken from South Dakota wetlands.

Koch, now a junior, soon graduated from picking critters out of muck to a summer research project where he worked with Jake Kerby, Ph.D., associate professor of biology, measuring how pesticides affect amphibian stress levels. The research brought Koch into the field to catch tadpoles and also gave him his first glimpse of the challenges faced by even the most well-prepared scientists. The experiment, which involved placing amphibians in water laced with pesticides and measuring the animals’ stress hormones, failed to produce usable results. Still, the experience offered a valuable lesson.

“The adversity, the tedium, all the things that make it hard to get results, that’s what makes actually getting results really fun and rewarding,” Koch said.

His latest project—and the topic of his honor’s thesis—is yielding some interesting data. Working with Professor Ken Renner, Koch uses mantis shrimp to measure brain neurotransmitters, such as dopamine and serotonin, in response to aggressors. This species of shrimp is notoriously hostile and territorial and possesses a spring-loaded appendage that delivers a punch with the force of a 22-caliber bullet. Koch sets up experiments that force a fight between two shrimp and then anesthetizes the animals, removes their brains, and measures the neurochemicals of the fight’s winner as well as that of the defeated shrimp. Results of the study will add to the literature on neurotransmitters’ effects on the brain, which may ultimately lead to advances in drug developments for humans.

As an undergraduate researcher, Koch said he’s worked hard to find jobs in some prestigious labs on campus. In addition to getting good grades, he seeks out faculty members with whom he wishes to work. “It’s all about building connections and not being afraid to talk to people,” he said.

Related to his research is Koch’s role as vice president of the AWOL (Alternative Week of Off-Campus Learning) program at USD. On various service trips to work with Native Americans on South Dakota’s reservations, Koch said he saw an opportunity to take his interest in medicine and neurobiology and apply it to serving communities with limited access to quality mental health services. That’s why Koch took on yet another research project—this one with faculty at the USD School of Medicine—which studies adolescent stress in relation to environmental factors. “Every time I spend a week in one of these communities it strengthens my commitment to helping to provide resources so people living there may be successful,” he said.

Although he began USD strictly on the pre-med track, Koch said he now sees a combined M.D./Ph.D. program in his future. The dedicated young scholar has already committed to at least another decade of school. “I plan on being in college until I’m 34,” he said. “Seriously.”
From the Dean’s Desk…

The path to discovery is not an easy one. Students may spend months alone in library archives, diligently rummaging through understudied documents in order to ferret out new information or gain exceptional insights; they may be part of a large research team that discovers new scientific knowledge, but only after many failed experiments in a laboratory setting. The research process requires diligence and stamina. I still recall my own run at original research as an undergraduate, writing a six-chapter honors thesis on national trends in Senate elections.

The undergraduates profiled on these pages tackled the difficult process of discovering and creating new knowledge. Our faculty welcome and mentor these budding scholars. In fact, I am pleased to report that the majority of undergraduate students who participate in funded research on the USD campus have their academic home in Arts & Sciences.

Fostering the intellectual curiosity of students is a role we take seriously, mindful of the fact that our young people will have been tested and emerged as better-informed students. We hope you enjoy these stories—from Shakespeare to solar energy—that lie at the heart of our undergraduate research mission.

Matthew C. Moen, Ph.D.
Dean, College of Arts & Sciences
Lohre Distinguished Professor

Exploring Human Behavior Through Research

Like many first-year college students, Emily Hattouni entered USD three years ago undecided about her academic major and future career path. Her experience in one introductory-level course during freshman year, however, made the decision for her.

“I took Psychology 101 and fell in love,” said the Apple Valley, Minnesota, native. “It solidified my thinking that psychology would be a good foundation for anything that I wanted to do.”

Hattouni, who is majoring in psychology and minoring in communication studies, currently plans to pursue graduate school in clinical psychology when she graduates next year. Research experience will make her more competitive as an applicant to Ph.D. programs, she said.

“My first research experience was working on a study about the usability of different platforms for online textbooks,” she said. “It was fascinating to learn about human factors research but it wasn’t really related to my interest in clinical psychology.”

When she saw an opening for undergraduate assistants in the lab of Assistant Professor Sara Lowmaster, Ph.D., director of the department’s Clinical Psychology Program, Hattouni jumped at the chance to join a project related to her desired area of specialization.

Throughout the fall 2015 semester, Hattouni spent about three hours each week helping to edit and categorize photos of people making different expressions, which Lowmaster will use in a study on stress disorders. Hattouni’s job was to crop and color-correct each photo to ensure all aspects of the photo except the individual’s expression are identical. “It’s meticulous work,” she said. “But I can see my role in this whole project.”

Since Hattouni is studying abroad in England this semester, she won’t take part in actually running the experiment, but she hopes to assist with data analysis. She also plans to start gathering participants and data for her own honor’s thesis project, which will examine the concept of mindfulness in addressing psychological disorders. Hattouni’s project will take self-described “ruminators,” or individuals who obsess over negative experiences, and examine whether they can be taught to make a slight change in their thinking to “mindfulness,” which she described as thinking about an occurrence in a non-judgmental way. “Mindfulness is shown to have a positive impact on your life and positive effects on your body,” she said.

Hattouni said she is thankful USD offers opportunities for undergraduates to become involved in research and encourages students to seek out work on research studies, either as a paid position or a volunteer. “It’s one thing to read about research, it’s a lot different when you are actually involved.”
Archival Work Sheds Light on Shakespeare in South Dakota

“What I found interesting is how people used Shakespeare to advertise goods in their communities.”
—Chelsea Campbell

Like any intrepid explorer, Chelsea Campbell, B.A. ’15, had a specific goal in mind as she set out in the final summer of her undergraduate career to find evidence of playwright William Shakespeare’s influence on the lives of South Dakotans in the newly settled Midwest.

The English major from Sioux Falls had studied scholarly accounts that documented Shakespeare’s influence on communities in the East Coast and after the country’s expansion to California, but said little about the author’s impact in the country’s vast middle section. “In the 19th century, people are settling and farming in South Dakota, and mining in the western part of the state,” Campbell said. “We wanted to find evidence of Shakespeare’s presence in South Dakota during that time.”

Working with English Chair and Associate Professor Darlene Farabee, Ph.D., Campbell, with fellow undergraduate Mackenzie Stone, searched through reels of microfilm in the I.D. Weeks Library and visited the archives of the South Dakota Historical Society in Pierre. There, the researchers found newspaper reports of dramatic performances of Shakespeare plays in Mitchell, Aberdeen and other communities. Social Shakespeare Clubs formed in these towns as well. Club meeting minutes unearthed by Campbell showed the participants, who were mostly women, often spent an entire year of weekly meetings on one play. They also performed charitable work and helped start libraries in their communities. These documents showed a great interest in Shakespeare across South Dakota and among different social classes, but Campbell also found other references to the English playwright as she pored over 100-year-old newspapers.

“What I found interesting is how people used Shakespeare to advertise goods in their communities,” Campbell said, describing an ad for Hostetter’s Stomach Bitters that appeared in an 1899 edition of the *Daily Deadwood Pioneer Times* and referenced Shakespeare’s tragic prince of Denmark. “Nothing ailed Hamlet but indigestion, which upset his liver, polluted his blood and made him nervous,” claimed the advertisement. “If it had been possible for Hamlet to have had Hostetter’s Stomach Bitters, he would have been a different character.” Other examples Campbell found use random quotes from Shakespeare’s plays to sell items such as clothing.

“In advertising you have to connect with consumers and use something familiar that will make them want your product,” Campbell said. “These advertisements show that Shakespeare is recognizable. My argument is these ads prove he was present and a part of everyone’s daily lives.”

Farabee and Campbell plan to present some of this research during the upcoming exhibit of the first published collection of Shakespeare’s plays, now known as the First Folio, which will take place at USD’s National Music Museum March 7 through April 2. Campbell will also present her findings on Shakespeare’s appearances in newspaper advertisements at the annual IdeaFest for undergraduate research this spring.

“Research in the humanities is important to understanding our culture in the past and how it shaped who we are today,” Campbell said. “And, personally, it’s just a really rewarding experience to put in 10 hours of looking for something and finally finding it. It’s a small victory but it feels so good.”
A Creative Approach to Solar Energy Use

How do the natural sciences stimulate creativity? Just ask Thorn Dramstad, a junior chemistry major from Huron. He has witnessed some innovative approaches to using solar energy to produce hydrogen as a fuel source while he worked in a chemistry laboratory of Ranjit Koodali, Ph.D., associate professor of chemistry.

“Dr. Koodali finds novel approaches to problems,” said Dramstad, an honors student who is minoring in musical performance and also plays violin in the USD Symphony Orchestra. Last summer, Dramstad had the chance to perform some creative experiments of his own in Koodali’s lab.

Using dye-sensitized solar cells, low-cost devices that employ dyes to capture light and convert it to energy, Dramstad’s research harnessed solar-simulated light to split water molecules into its components of hydrogen and oxygen. He then collected the hydrogen, which can then be used as fuel that produces no pollutants or greenhouse gases. Finding a way to create abundant amounts of this clean fuel using solar light is the ultimate goal of the study, he said.

Ground-breaking research results require adherence to strict investigative protocols, which Dramstad said he’s acquired through his hands-on work in Koodali’s lab. “I have learned how to do many experimental tests and how to analyze the results they produce,” he said. “Not only have I learned how, but I’ve learned when to use them and for what reasons as well.”

Dramstad urged students interested in working in the natural sciences to branch out beyond laboratory-based classes and consider finding a position working on a long-term research project. “Students gain knowledge of experimental techniques, laboratory etiquette, and critical problem solving skills,” he said.

After graduating next year, Dramstad plans to pursue graduate studies, eventually earn his doctorate and achieve a position as a chemist in an industrial setting. In the meantime, this disciplined student continues to play with the USD Symphony Orchestra and compete on the university’s Ultimate Frisbee team.