Scholar connects lab research to classroom innovation

Sit down to chat with Alesia Hruska-Hageman and you know instantly why she traded the research laboratory for the classroom: she is a teacher at heart.

As she enthusiastically explains the intricacies of DNA, RNA, proteins and the structure of a cell, you realize you are witnessing her gift to the world. Hruska-Hageman is an accomplished researcher whose focus is protein/protein interactions. But she is also a skilled and compassionate teacher intent on ensuring that her pupils understand the subject matter. And her enthusiasm is contagious.
Dr. Alesia Hruska-Hageman engages students in research, lab work and scientific discovery.
What is PICK1?

PICK1 (Protein Interacting with C Kinase 1) is a peripheral membrane protein that regulates the surface expression of protein receptors and transporters involved in the learning of memory, axonal guidance, and cancer.

Mount Mercy Assistant Professor of Biology Alesia Hruska-Hageman discovered the connection between two genes that encode proteins, Lumen Recruitment Factor (LRF) and DiGeorge Critical Region 6 (DGCR6) that interact with the protein PICK1. Hruska-Hageman made this important discovery at the University of Iowa while doing her post-doctoral research. She used a yeast two-hybrid assay to make the discovery, which is a molecular biology technique used to discover protein/protein interactions and protein/DNA interactions by testing for physical interactions (such as binding) between two proteins or a single protein and a DNA molecule, respectively.

PICK1 interacts with a number of membrane proteins such as AMPA Receptors, ASICs, Dopamine and Serotonin transporters via its PDZ domain (Xia, 1999; Hruska-Hageman, 2002 and reviewed in Xu, 2007). Studies have shown that PICK1 helps regulate the insertion of AMPA Receptors subunits and ASIC channels into and out of the cell membrane (Jim, 2006; Leonard, 2003). PICK1 has two other domains that are possible interaction sites, the BAR domain which binds to lipid membranes and an acidic region at its C-terminus. Recent studies have shown the BAR domain in PICK1 interacts with the BAR domain of another protein, ICA69 (islet cell autoantigen 69 kDa) forming heteromeric complexes that regulate the targeting and surface expression of AMPA receptors at synapses (Cao, 2007). This data suggests the BAR domain and the acidic domain of PICK1 could interact with other proteins to help researchers understand the function and regulation of PICK1. Hruska-Hageman’s research program investigates the function and regulation of PICK1 by studying the proteins interacting with the BAR domain, the acidic domain, or both domains of PICK1.

LRF is involved in the unfolded protein response, a process of correcting misfolded proteins which occurs when the endoplasmic reticulum is stressed (Audas, 2008). Hruska-Hageman asserts that the interaction between LRF and PICK1 may be important for this process to occur. Deletions of the gene for DGCR6 have been linked to disorders like DiGeorge syndrome and schizophrenia (Liu, 2002). Interestingly, mutations in the gene encoding PICK1 may be linked to schizophrenia (reviewed in Dev 2006) and the interaction between PICK1 and DGCR6 may be important in preventing these disorders from developing.
“My passion for topics comes out when I teach,” says Hruska-Hageman, “and I think students can see that.”

They do indeed.

“Dr. H has a genuine interest in helping her students understand very complex material,” says Matt Hakeman, a senior biology major from Williamsburg, Iowa. “She also pushes her students to be as academically strong as possible, and she shows the relationships between what we are learning in class and how that information can be applied to the real world.”

**Bringing research into the classroom**

Another characteristic that qualifies Hruska-Hageman as a “great teacher” — as her students and colleagues call her — is her interest in and ability to involve students in research. While conducting post-doctoral research at the University of Iowa more than seven years ago, Hruska-Hageman discovered the connection between two genes that encode proteins, Lumen Recruitment Factor (LRF) and DiGeorge Critical Region 6 (DGCR6) with another protein, PICK1, of PICK1 within the cell by studying proteins that interact with PICK1’s BAR domain and C-terminal acidic region. “I think it is important to engage students in research because it teaches them to think critically and analyze data, and to really focus on a project,” she says. “They learn how to manage their time and estimate how much time things take in a lab setting. When students start understanding things they ask more questions, and they learn to communicate their findings to each other and to other audiences.”

Hakeman and Hruska-Hageman have formed a close relationship while working together on research experiments, particularly while co-writing the R.J. McElroy Student/Faculty Research proposal, which Hakeman will pursue next school year. “Dr. H is a passionate professor who is determined to bring research experiences to Mount Mercy and her students,” says Hakeman. “Being involved in a program that expands the classroom knowledge base is a tremendous opportunity. Dr. H and I already have a strong bond and working side-by-side with a professor on biological research will extend the classroom material far beyond the walls of Basile Hall.”

Dr. Will Kirkland, a colleague of Hruska-Hageman’s in the biology department, echoes Hakeman’s praise. “Alesia is very thorough and conscientious in her approach to teaching and mentoring students,” says Kirkland. “She most definitely is...
a student advocate. She is very patient with students who have questions and is very capable of explaining things in different ways to assist student understanding. She has an open door policy and gladly visits with students about their potential careers.”

“I believe that students react positively to Alesia’s passionate teaching style. She asks a lot of her students, but she works every bit as hard as she asks her students to work. They may not realize it, but her hard work makes their learning experience the positive experience that it is. They are very fortunate to have her in the classroom,” says Kirkland.

The teaching bug

Hruska-Hageman earned a Bachelor of Arts degree from Luther College, Decorah, Iowa, where she was one of the few students to double-major in art and biology. Although she made biological sciences her career, she continues her passion for the arts through card-making, and also plans to teach a January term 2010 class on scrapbooking. She earned a Ph.D. from Iowa State University before starting her post-doctoral research at the University of Iowa. While at the University, she was a Howard Hughes Research Associate in Dr. Michael J. Welsh’s laboratory and published several papers on her research, including the cover of the *Journal of Biological Chemistry* Volume 279 Issue 45 in 2004.

“I always knew I wanted to teach,” says Hruska-Hageman, “I just didn’t know at what type of institution until I was in graduate school.” She credits being a resident assistant at Luther College with igniting her spark to mentor and teach others. Then, Hruska-Hageman made an important connection with Welsh based upon their similar baccalaureate experience – he was a graduate of Loras College, Dubuque, Iowa. During an interview for a research position with Welsh, he inquired about her future aspirations.

Hruska-Hageman didn’t miss a beat: she responded that she wanted to teach at a small private college.

“People come to my lab with a variety of aspirations and goals,” says Welsh. “As their work progresses and they develop a variety of experiences, their goals sometimes evolve as they see how they can make their mark on the world. Alesia came with the goal of teaching in a college environment and it remained during her training.” Welsh also notes that Hruska-Hageman was an asset to the laboratory and that her protein/protein research has influenced other scientists. “She worked hard, paid good attention to her data, and let her results drive her experiments,” he says. “She also interacted well with others, and contributed to the success of others in the lab. She had several papers of which I am quite proud and that have influenced the direction of the field.” Welsh’s praise for Hruska-Hageman also extends outside the research laboratory. “I think she is an excellent teacher because she enjoys teaching, she works hard at it, and she receives satisfaction at seeing her students succeed.”

Mount Mercy energizes focus on scholarship

Hruska-Hageman came to Mount Mercy prior to the institution’s new strategic plan, but her background and interest in engaging students in research fit well with Mount Mercy’s mission and goals. With the support of President Christopher Blake, Provost and Vice President for Academic Affairs John P. Marsden initiated the Summer Scholarship Award program to fund faculty-student research projects, and Hruska-Hageman’s proposal was accepted for the summers of 2008 and 2009, guaranteeing that progress would be made on the PICK1 research.

“Smaller institutions like Mount Mercy often educate a number of students who go on to graduate school due to the strong mentoring relationship that is developed when faculty members involve undergraduate students in their research,” says Marsden. “Faculty at small colleges with a demanding teaching load and limited resources appreciate the student help. Faculty can pursue scholarship, share their enthusiasm for their discipline, and teach through their research.”

Hakeman is one student who feels that the emphasis on and opportunity to conduct research will benefit him in his future career. “This research will give me a competitive advantage when I apply to medical school and move on to the next chapter in my life after Mount Mercy,” says Hakeman. “I have had research experience last summer with a Commercial Corn Breeding Internship with Monsanto, but I want to study biology in a more controlled setting, such as a lab. This experience is something that is unique to a very small percentage of individuals at the undergraduate level. I plan to make science my career, and Dr. H is one of many people who keep pushing me to reach my potential.”
“I believe that students react positively to Alesia’s passionate teaching style. She asks a lot of her students, but she works every bit as hard as she asks her students to work. They are very fortunate to have her in the classroom.”

Dr. Will Kirkland, Mount Mercy biology department