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Kristen Johnson: Professor of Biotechnology

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In the *Odyssey*, when Odysseus departs for the siege of Troy, he leaves his friend Mentor, a wise, older man, in charge of his son and palace. Mentor is to watch over and guide the young Telemachus. In the seventeenth century, Mentor became a verb, *to mentor*, with its current meaning of individual guidance of a (usually) younger, inexperienced person by an older, more experienced teacher or tutor. Here we profile two University of New Hampshire faculty members who have frequently mentored undergraduates, including *Inquiry* authors.

Mentor Highlights: Kristen Johnson

—Brigid C. Casellini

Kristen Johnson is an assistant professor of biotechnology at the University of New Hampshire at Manchester. Below is a correspondence with Dr. Johnson about her own research and her mentoring experiences with undergraduate students.

***Inquiry*: What is your research focus? Did your undergraduate studies point you toward it? What interests you most about it?**

Dr. Kristen Johnson

My research is focused on understanding the molecular underpinnings of pancreatic cancer. Pancreatic cancer is one of the most devastating cancers with a dismal 10% five-year survival rate and it is the fourth leading cause of cancer related deaths despite accounting for only 3% of cancer diagnoses. There is a desperate need for greater understanding of the mechanisms by which pancreatic cancer progresses, as 80-85% of patients are diagnosed with advanced disease that cannot be removed surgically.

Our lab at UNH Manchester has a particular emphasis on studying transcription factors that function in the progression of pancreatic cancer. We have identified a role for the FOXN2 transcriptional regulator in invasion and metastasis, and presently we are evaluating the molecular mechanisms by which FOXN2 mediates its effects in human pancreatic cancer cells.

Studying cancer has been a general interest of mine since I was a graduate student in the lab of Tyler Jacks at MIT. The Jacks lab focused on creating many mouse models of cancer, and my work focused on the Nf2 gene, which is involved in Neurofibromatosis type 2 and other cancers. For three years as a graduate student, I mentored an undergraduate. This was a great learning experience

and it certainly helped me hone some of my early mentoring skills. Out of my graduate research work, I gained an appreciation for and interest in cell motility, adhesion, and the cytoskeleton, and this underlies much of the work that we do in the Johnson Lab today.

As an undergraduate at Dartmouth College, I participated in research through the Women in Science Program. I studied the impacts of thyroid hormone on *Rana catesbeiana* (American bullfrog) metamorphosis. I enjoyed doing tadpole research so much that I even snuck a pre-experiment tadpole back to my dorm room as a pet. I became a bit obsessed with frogs, and everyone I knew took advantage of this. Let's just say that my collection of frog trinkets was out of control by the time I was married. Overall, this research experience and my ability to work under a female principal investigator (PI) and female post-doc mentor in the lab was very inspiring. My enhanced understanding of molecular biology from the many experiments I carried out in the lab complemented my lecture-based learning very well. My three years of research were a very important part of my undergraduate education and encouraged me to pursue my PhD.

***Inquiry*: What is the purpose of a mentoring relationship? What should the student and you gain from it?**

In my mind, the purpose of mentoring is to foster relationships that result in positive outcomes. These outcomes range dramatically depending upon the individual student. While some students do not really know what they want/need out of a mentoring relationship, others very clearly indicate this in words or other directives. While some of the students that I mentor go on to graduate programs in biology, others have chosen paths leading to health professions, and others have progressed directly to the biotech industry. The diversity of relationships that exist when mentoring makes it both exciting and at times challenging.

My hope is that through their research in my lab, students feel empowered to launch to the next phase of their educational journey or career. Students should walk away from a research experience with a sense of self-identity (thinking of themselves as a scientist) and self-efficacy (confidence in functioning as a scientist). An additional portion of my mentorship is to meaningfully engage with students based on each individual's interests and talents to help them along their path with resources, advice, and educational and industry connections. I gain satisfaction seeing my students increase their confidence, grit (research is filled with ups and downs!) and succeed in whatever path they choose.

Some of my mentorship extends post-graduation as well. Many of my former research students and I keep in touch, and I am always open to hear about both their successes and struggles as they navigate the next stage of their life. I enjoy conversing with these students as they negotiate transitions in their educational paths or careers.

***Inquiry*: What different types of mentoring experiences have you had (i.e. through courses, independent studies, grant-funded projects, presentations, etc.)? Please describe any especially memorable mentees.**

I have had the opportunity to mentor students in a variety of settings.

The research in my pancreatic cancer lab is largely funded through NH-INBRE grants. Undergraduate students drive the progress of our research, and I have between five and ten undergraduates in the lab each semester and over the summer. Students participate in this

research by receiving course credit for independent research or independent studies or by receiving pay through the grant. We have also had students receive Undergraduate Research Awards (URA), Summer Undergraduate Research Fellowships (SURF), and Research Presentation grants from the Hamel Center for Undergraduate Research, as well as and Manchester Undergraduate Project Support grants. All students that participate in research projects present their work at our UNH Manchester Winter Symposium or at the annual UNH Undergraduate Research Conference (URC). Additionally, many students have presented their research at local and national conferences, such as the American Association for Cancer Research (AACR) Pancreatic Cancer Conference.

I have had a number of excellent trainees in the lab. I particularly enjoy mentoring women, as I harken back to my undergraduate days at Dartmouth and the female role models that shaped my undergraduate research and my future. While female representation in STEM is certainly getting better, it is important that women see a positive path to success and feel empowered with the tools to achieve their goals.

In addition to my cancer research lab, I teach several CUREs (Course-based Undergraduate Research Experiences): Phage Discovery and Phage Genetics, Synthetic Biology, and Cell Culture. These wet lab-based projects are an opportunity for many students to engage in novel research in a class setting. This type of mentorship is very different from that in my research lab, in that it is usually contained within a single semester. It is very exciting for me to enable so many students to engage in authentic research and to witness their project ownership, increased confidence, and grit throughout the process. Projects out of the Phage Discovery and Bioinformatics labs have resulted in publications. Currently, I am working with three of our Millyard Scholars to write a manuscript based upon their synthetic biology project data from fall 2021, and they will be attending a conference to present their research this spring.

***Inquiry*: Have you experienced any difficulties or problems in mentoring undergraduates?**

Mentoring undergraduates is very rewarding. Our students at UNH Manchester are a diverse, talented, and hard-working group. However, because of the demands that some students have on their time (working part-time, family commitments, etc.) making adequate time for research can be difficult. In particular, in our cell culture lab, certain experiments must be carried out with very precise timelines. Working together to create schedules and block out experimental timelines can be challenging, but partnership with students and setting them up in teams can enable success.

Many of my difficulties when mentoring undergraduates have resulted from me taking on too many students at one time. When I have done this , I have spread my mentoring too thin and not been able to spend enough time actively mentoring each student in the most effective manner.

***Inquiry*: What advice or tips would you give a faculty member new to undergraduate mentoring?**

Be easy on yourself. Be sure that you set up a lab meeting time that can incorporate all of your undergraduate students so that they feel included in your research team. Confidence can come from having undergraduates work together in small teams.