DNA studies evolve through faculty-student collaboration

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The following article was submitted by the University of Wisconsin Oshkosh Faculty Advocacy Committee, a committee of the Faculty Senate. The introduction was written by Dr. Arlene Haffa, a faculty member in the chemistry department at UW Oshkosh.

Introduction:

Jason Busse has been an extremely vibrant student to have working with me. I have really enjoyed working with him because of his true interdisciplinary interests in science, music and language.

He typically arranges meetings for early in the day (often before 8 a.m. classes) and always arrives on time and ready to work. This allows him to not only be a full-time student in computer science, but also to teach guitar lessons and to be a member of a successful band.

Jason found his way into my research group by asking Dr. Wing Huen, his computer science professor, for extra work. Dr. Huen and I had just established a collaboration, and Jason fit right in. In our collaborative meetings he was often the communicator between us. He was willing to learn from both of us to try and develop software tools to study DNA sequence data.

The tools that Jason is nearly done creating will be freely available to the broader scientific community. I believe they will be useful in establishing genomic relationships. Jason will be graduating from the College of Letters and Sciences this spring. He is a solid example of what a student earning a liberal education should look like.

Questions answered by Jason Busse, student researcher:

Describe the project on which you and professor Haffa are working.

The genetic makeup of many species is stored in publicly accessible databases by the U.S. government. Professor Haffa has developed a new method of comparing DNA sequences. Most scientists usually only look at the parts of the sequences that are the same. This new method uses the similarities and the differences in the sequences at the same time and, thus, allows one to see how the changes in DNA sequences came about.

Using this method, she has shown that some species of bacteria are closely related when looked at using the traditional methods but have had large-scale modifications following viral infection. These abrupt changes completely alter the species. For example, a photosynthetic bacteria that could swim was changed into a non-photosynthetic bacteria that was unable to move on its own. These are not the slow changes over generations described by Darwin

Though there have been promising results, the immense size of the data files makes manual processing prohibitive. My portion of the project is the development of software tools that can be used to expedite the process of analyzing all the DNA data.

How is the work that you are doing important?

Once it is easier to process the data, we will be able to identify evolutionary relationships between organisms that were previously unknown. This will further our understanding of the diversity of life.

What got you interested in the project?

I was very excited to get involved in a real research project instead of contrived problems created for classroom work.

What kind of work does your project entail?

I must design, develop and test software tools that are accessible online. In order to be successful, I have learned about biochemical data from Dr. Haffa as well as computational methodology from Dr. Huen.

What outcomes do you anticipate from this collaboration?

I have nearly completed a website with the tools necessary to rapidly process genomic data in this novel way. It will be freely available to the research community. I anticipate that there will be published papers explaining the results of the comparisons we made using this method.

What has been the most valuable part of this experience for you?

Dr. Haffa, Dr. Huen and I have had many meetings. Initially, the meetings involved explanations of the data analysis needs and discussions of the requirements for dissemination of the data. As time progressed, the discussions changed from general ideas to specific mechanisms of the software. The most exciting experience occurred as a result of all these meetings.

One day, I had an epiphany in regard to my choices with this project. Most often in the classroom, we are told which methods to utilize to complete a project. It dawned on me that in this project I got to choose how to implement the software and my decisions directly impacted the success of the project. I found this idea exhilarating.

In what ways has your professor guided you in this collaboration, and how do you feel about your own contribution to this work?

Professor Haffa and I come from different fields. She knows chemistry and microbiology, and I am pursuing a degree in computer science. I have learned a great deal about the science behind her work and general knowledge in her discipline. As a computer scientist, I have found that understanding the way the scientists intend to use my product is crucial to having a successful outcome.

What are you learning that you may not be able to learn in the classroom?

In these real world interactions, I learned that what is expected or understood by one person is not always expected or understood by others. Careful planning and continued conversation are necessary factors in the creation of useful software. I really enjoyed the amount of freedom provided by professor Haffa.

Would you recommend this kind of experience to other students?

Definitely. I would recommend this kind of experience to all students.

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