



2011 Functional Genomics Institute Helps Faculty Teach Students Ways to Answer — and Introduce — Questions for Biology Research

Hiram College in northeast Ohio was the host of the second annual ASM/JGI Functional Genomics Institute, a program that helps faculty incorporate the growing field of functional genomics into undergraduate classes. Genomics involves the use of complete DNA sequences to generate testable ideas about how an organism makes a living and interacts with other organisms. Functional genomics is a set of lab strategies and tools that allow researchers to experimentally test those hypotheses and connect genes to the overall biology of the organism. For 13 undergraduate educators from across the U.S. and Australia, the Institute was a series of how-to sessions on building one course or an entire curriculum around functional genomics research. During 17-21 July 2011, the star was *Thiomicrospira crunogena*, a sulfur-oxidizing, carbon-fixing bacterium of the deep ocean. In addition, participants worked with the soil bacterium and sometimes plant pathogen *Agrobacterium tumefaciens*, and discussed how to use other “non-model” microbes in course research projects.

“The beauty of incorporating functional genomics in undergraduate education is the multiple entry and exit points for students to engage in genuine research,” says Brad Goodner, Professor of Biology at Hiram College. “Students can analyze open reading frames or use sequence similarity to assign putative gene functions, but there is nothing like an experiment that proves a gene function to turn on the light bulb for most students.”

Before students can jump into functional genomics, their instructors must feel comfortable with the experimental strategies, the necessary tools and reagents, and do’s and don’ts of making it work with a course framework. To that end, Goodner teamed up with Kathleen (KT) Scott of the University of South Florida, Christopher Kvaal of St. Cloud State University, Jim Hu of Texas A&M University, Steve Slater of the University of Wisconsin, and Katherine (Kt) Houmiel of Seattle Pacific University to put together a rigorous program of classroom sessions, laboratory work, and small-group discussions. Topics included transposon mutagenesis, deriving gene annotations from published research literature and the use of Web-accessible sequence analysis tools, gene knockouts, functional complementation, protein expression, and RT-PCR analysis of gene expression. The multi-format program offered participants access to curriculum activities, problem sets, exercises, and research projects designed to engage undergraduate students and ready for use in courses immediately.

“We were really lucky this year to not only have the support of ASM and the U.S. Department of Energy Joint Genome Institute, but also support from several government and non-government funding agencies,” commented Goodner. “KT Scott and her collaborators on a USDA education grant wanted to expose more educators to the wonders of deep sea microbes and the Institute was the perfect venue. KT gave the participants a tour de force of how a cool bacterium such as *Thiomicrospira crunogena* that lives near deep-sea hydrothermal vents can be studied in multiple ways by students right on their lab bench. Jim Hu, whose work on the GONUTS wiki project is supported by NIH-NIGMS grants, showed participants how students can enrich gene annotations by connecting them to the research literature. Steve Slater and Kt Houmiel demonstrated how some new cloning strategies and reagents, supported by a Monsanto Fund educational grant, allows functional complementation to be easily incorporated into a course format. Finally, Chris Kvaal and I introduced participants not only to wet-lab projects but also to other available faculty development opportunities such as the Microbial Genome Annotation Network supported by a NSF RCN-UBE grant. The Institute was a great example of the power of networking and sharing best practices.”

In a post-institute survey, participant feedback reflects the value of the experience: 100% of respondents indicated that they would recommend the institute to their colleagues. In particular, respondents cited improved abilities to not only comprehend molecular and bioinformatics techniques and but also think outside the box in terms of integrating functional genomics in their courses. One respondent noted that a very useful part of the institute was learning that undergraduate research projects could be conducted in a single semester in which students could gain hands-on experience in “doing science.” Through functional genomics, students and their teachers have an exciting opportunity to not only answer questions about known genes but also identify thousands of new genes — and questions — for future research.

The Functional Genomics Institute is managed by ASM and sponsored by the U.S. Department of Energy Joint Genome Institute and Hiram College. The institute is one of several learning opportunities that ASM offers to biology educators via its faculty programs. The next institute will be held in 24-28 June 2012. To learn more, visit www.facultyprograms.org.

ASM/JGI Functional Genomics Institute

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