BioQUEST Notes

Volume 12 Number 1 *A publication of the BioQUEST Curriculum Consortium* Fall 2002

Items Of Special Interest In This Issue:

A Report from the 2002 BioQUEST Summer Workshop

Biocomplexity in Undergraduate Education: From Hard Data to Hard Decisions

Joshua Tusin
Director of Public Relations, Journal of Young Investigators

"I came back to Beloit to talk about biology with people who love biology," says Lynn Gillie, a vertebrate biologist, "Biocomplexity was a really attractive topic."

The Biology floor of Chamberlin Hall at Beloit College was packed with enthusiasm, ideas, colleagues, and friends from 11 countries for this year's BioQUEST Workshop, *Biocomplexity in Undergraduate Education: From Hard Data to Hard Decisions*. The theme brought in educators from many disciplines, making the conference as biocomplex as the subject. Professors John Greenler and Robin Greenler of Beloit College chaired the workshop.

Dan Flath, a mathematician who has incorporated other disciplines into his calculus education, was everywhere during the conference asking questions of everybody. "The first few days have probably changed my teaching a lot already," Flath says, "the key to teaching anything is listening to the students. They will tell you what they need."

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2003 BioQUEST Summer Workshop

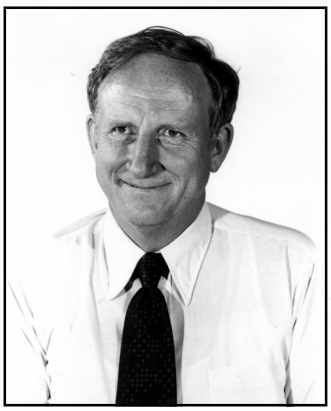
Enabling Exploration for Everyone, Everytime, Everywhere: Collaboratories, Digital Libraries, and Computational Biology Education

Beloit College **May 31–June 3**

http://bioquest.org/indexworkshop2.html

For more on this workshop, see page 3.

BioQUEST Consortium News



BioQUEST is saddened to share the loss of our good friend, H.T. Odum, who died on September 11, 2002. As a friend to many and a vital member of the BioQUEST Consortium, he will be missed.

Presentations and Representation

June

- 2002 BioQUEST Workshop, *Biocomplexity in Undergraduate Education: From Hard Data to Hard Decisions*, Beloit College, Beloit, WI
- BSCS Evolution Writing Workshop, BSCS (Biological Sciences Curriculum Study), Colorado Springs, CO
- Society for the Study of Evolution, University of Illinois in Urbana-Champaign

July

- Annual Meeting of The Society for Mathematical Biology 2002, *Education in Mathematical Biology* Mini-symposium, Knoxville, TN
- Biotechnology 2002 Educator's Conference, *Bioinformatics in the Curriculum: Microbial Amylases, Snack Foods*, and *The Internet and Investigative Case-Based Learning in Biotechnology: Exploring Cases on Bt-Corn, Mad Cow Disease, and Industrial Microbes*, Blacksburg, VA

August

- Mathematical Association of America Annual Meeting, Math Fest, Burlington, VT
- Botanical Society of America 2002, *A Problem-solving Approach to Using Bioinformatics in Biology Education: Investigating One Cell with Three Genomes*, and *Of Cabbages and Kimchee: Investigative Case-based Learning Activities from Recipes Gone Wrong to Real-time Data Acquisition*, University of Wisconsin-Madison, Madison, WI
- 87th Annual Meeting of the Ecological Society of America, *Biocomplexity in Undergraduate Education*, Tucson, AZ
- DIMACS (Discrete Mathematics and Theoretical Computer Science) Reconnect Conference 2002, Rutgers University, Piscataway, NJ
- 2002 LifeLines Workshop, *Implementing Problem Solving Strategies: Investigative Cases for Biology and Chemistry*, Emory University, Atlanta, GA

September

- ACUBE (Association of College and University Biology Educators)—Annual Meeting, Columbia College, Chicago, IL

October

- National Association of Biology Teachers, 2002 National Convention, *Investigative Case-Based Learning in Introductory Biology and Bioscene: Journal of College Biology Teaching*, Cincinnati, OH
- HHMI (Howard Hughes Medical Institute) Undergraduate Program Directors Meeting, Chevy Chase, MD
- BEDROCK Workshop, *Bioinformatics in Biology Education: Working with Sequence, Structure and Function*, Sunnyvale, CA
- Murray State HHMI Review, Murray State, KY

2003 BioQUEST Summer Workshop

Enabling Exploration for Everyone, Everytime, Everywhere: Collaboratories, Digital Libraries, and Computational Biology Education

Saturday, May 31–Tuesday, June 3, 2003
Beloit College
Beloit, Wisconsin

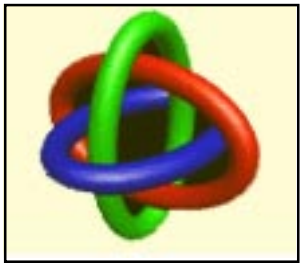
For seventeen years the BioQUEST Curriculum Consortium has strived to place powerful, professional tools into the hands of students as well as empowering them through active participation in problem posing, problem solving, peer review, and publication. How will we embrace new opportunities that exist for collaboration, communication, computation, modeling, simulation, visualization, and data mining? How will these new technologies enable us to further the long-term BioQUEST goals of broad access, equity, and cross-disciplinary linkages? Clearly, the technical barriers to accessing rich information, running analyses on supercomputers, and communicating broadly are constantly being lowered. How can we take educational advantage of these opportunities and tools to help us bridge the social, intellectual, national, and cultural barriers and connect more deeply with learners?

With creativity, we can broaden our vision of how to utilize emerging technologies (networking, computational power, informatics). Technology-enabled changes in undergraduate science education need not merely reflect an emphasis on doing more efficiently what we already do by creating electronic versions of old material. BioQUEST has tried to move curriculum development from the consideration of helping us teach more efficiently to helping students learn more effectively. Now, we need to think about breaking down the barriers between individual campuses, classrooms and laboratories; how will linking learners, data, tools, and analyses transform the student's learning landscape?

We encourage applicants to join us in developing white papers on establishing a variety of new agendas for biology education reform. First, collaboratories have made it possible for investigators to have access to high-end scientific equipment over vast regions of spaces and at odd times; how do we build on or transform access to these tools to suit the needs of educators and students? Or is a distinctly different kind of collaboratory needed for science education that employs the electronic notebooks, communication, and sharing potential of other collaboratories? Second, with the major strides being made to establish national science, mathematics, engineering, and technology educational digital libraries, how will we utilize these resources? Third, with the explosion of applications under the umbrella of computational biology, we are moving from period of minimal professional software and primarily toy data sets being available to students to a huge abundance of complex choices. How will we develop criteria for choosing appropriate software, hardware, and problem environments to fully serve student scientific exploration?

Borromean Rings—the synergy of collaboration

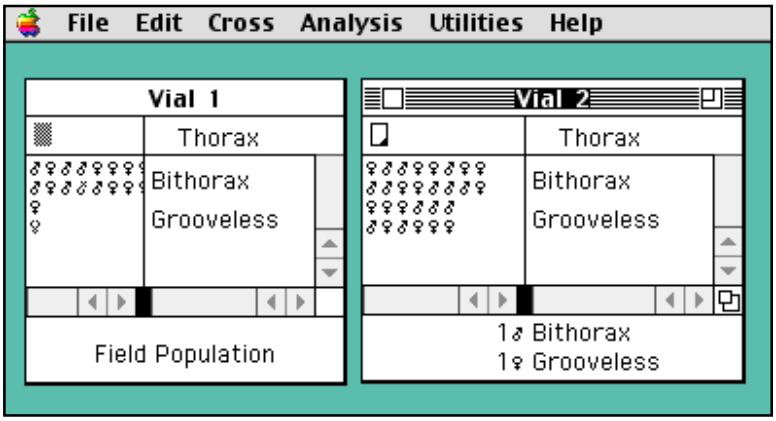
Computer and Communication Science



Behavioral & Organizational Science

The User's Domain

Field Test a New Version of the Genetics Construction Kit for Macintosh Users



The *Genetics Construction Kit version* 1.1B4 is available for field testing. *GCK* 1.1B4 is the latest update to the beta version of *GCK*. Version 1.1B4 is a "beta version" because, unlike the standard version of *GCK* (version 1.03), it has not yet been extensively tested in the classroom. By becoming a field tester for the beta version of *GCK*, you and your students can provide the feedback essential to the creation of quality educational software. In addition, you will have the opportunity to use *GCK* 1.1B4 in your classroom for one year at no cost. See below for additional details.

How does the beta *GCK* differ from the standard *GCK*? The beta *GCK* is a major revision of the standard GCK that adds support for a number of genetic phenomena, including:

- Traits which affect viability, sterility, or recombination frequencies,
- Single traits controlled by multiple loci (genetic interactions, epistasis, and additive polygenes),
- Multiple traits controlled by a single locus (pleiotropy), and
- Traits which are differentially expressed in different sexes.

In addition, *GCK v 1.1B4* fixes several bugs that caused the original beta *GCK* (version 1.1B2) to be unstable in some situations. These include:

- Fixed a number of problems that caused crashes with multi-trait problems.
- Fixed a bug that caused a crash when the Copy Window command was selected in Systems 8.6, 9.x, and in Classic mode on System X.

There are no differences in the interface available to the average user. The problem construction kit is changed significantly to give access to the new functionality.

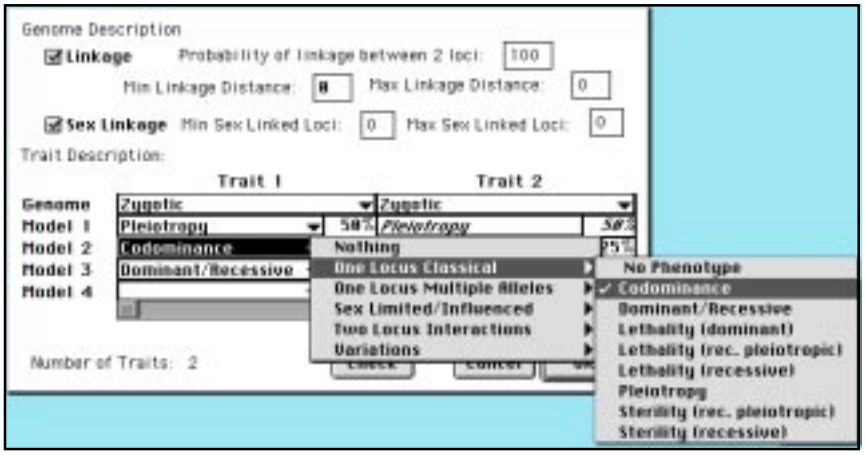
GCK is available for Macintosh computers only.

How do I become a field tester?

Field testers for The BioQUEST Library agree to use a specific Library module in a course and to provide BioQUEST with student response, instructor concerns, or other feedback, including an evaluation of the module at the end of the test period. The field test license allows you to use the module with your students on multiple computers for a period of one year. In addition, after submitting your evaluation, you will be given the opportunity to receive a 50% reduction in the price of your next purchase of the Library.

In addition to the beta version of GCK, many other modules in the BioQUEST Library are also available for field testing. If you are interested in field testing GCK or one of the other BioQUEST modules, or if you would like more information about the field test process, please contact:

Virginia Vaughan
Managing Editor, The BioQUEST Library
vvaughan@hamilton.edu



LifeLines OnLine at Emory University: Investigative Case Based Learning Gains New Fans

This August, over 30 biologists and chemists from Emory, Clark Atlanta, and Perimeter College attended a LifeLines OnLine workshop at Emory University. The workshop, *Implementing Problem Solving Strategies: Investigative Cases for Biology and Chemistry, (http://www.sciencenet.emory.edu/coll_curr/pbl_biochem_summer2002.html)* examined issues as diverse as bioinformatics, genetics and environmental chemistry while focusing on investigative case-based learning. The participants incorporated tools, modeling, and simulations from the BioQUEST Library as well as the Internet into cases they were developing. The workshop was led by Margaret Waterman from Southeast Missouri State University, Peter Woodruff from Champlaign College, and Ethel Stanley from Beloit College.

Participants developed an investigative case-based learning module for a course they are planning to teach this year. Modules emphasized open-ended, student-centered approaches while addressing practical issues such as implementation challenges, assessment strategies, and student preparation. Investigative cases developed included topics such as the chemistry of restoring faded photographs, treating staph infections that exhibit antibiotic resistance, government regulation over the exchange of science through the patenting and marketing of GMOs, and identifying potential species for a new fishery.

For more information on these and other cases, visit the LifeLines OnLine website at *http://www.bioquest.org/lifelines/.*

BioQUEST Collaborates with Shodor Education Foundation

The Shodor Education Foundation, Inc.

Our partnership with the Education, Outreach and Training Partnership for Advanced Computational Infrastructure (EOT-PACI) continues to offer new outreach possibilities. BioQUEST is pleased to announce plans to work with the Shodor Education Foundation on the development of a computational biology online course and to support workshops for 2003. Collaborators on the project also include the National Center for Supercomputing Applications and the University of Illinois at Urbana-Champaign.

The Shodor Education Foundation *(http://www.shodor.org)* utilizes computational and communication technologies to support "authentic interactive learning environments which are learner-centered, group-oriented, and discovery-based." Shodor currently provides workshops and internships to faculty and students on general modeling, Internet science, math explorations, medicine, forensic science, astrophysics, environmental science, scientific computing, and computational chemistry.

The computational biology project is part of Shodor's NSF funded National Computational Science Institute (NCSI) to support the hands-on use of computational science, numerical models, and data visualization tools across the curriculum.

Bioinformatics Education Dissemination:

Are you ready to teach biology in the 21st century?

The use of computer based analytical tools on electronically stored and distributed data is fundamentally changing life science research and its application to problems in medicine, agriculture, conservation, and forensics. In light of this "information revolution," undergraduate biology curricula must be redesigned to address not only the new knowledge that is emerging but also the new research tools and methods for building that knowledge.

The National Science Foundation funded BEDROCK initiative (*Bioinformatics Education Dissemination: Reaching Out, Connecting and Knitting-together*) is a new BioQUEST project with the goal of enhancing, expanding, and empowering a national community of bioinformatics educators. By working with faculty who can take a leadership role in bioinformatics education and highlighting innovative approaches to incorporating bioinformatics throughout undergraduate biology education we hope to establish and disseminate robust models of innovative teaching in this emerging area. The project activities include a series of faculty development workshops around the country, collecting and disseminating bioinformatics education materials, and developing a networked collaboratory environment for sharing bioinformatics teaching resources.

Have you thought about how you are going to incorporate bioinformatics into your teaching?

This is an exciting time for biology education. The collection and analysis of molecular data is having a growing impact on all our lives and, at the same time, is providing new opportunities and challenges for undergraduate education. Three factors in particular make this a unique time to explore new ways to teach:

- A rich collection of research data and tools are now easily accessible in the public domain;
- faculty recognize that they need to seek professional development to stay abreast of the changes in biological knowledge and techniques; and,
- students are aware of the changes in biology, understand that solving biological problems is relevant to their lives, and realize that bioinformatics skills hold possibilities for future employment.

Taken together, the convergence of these factors affords us all an opportunity to move curriculum reform beyond the relatively small group of "early adopters" into the main stream of biology faculty and undergraduate courses.

The BEDROCK project will provide a focal point for change in this emerging area of science education. Because bioinformatics is such a dynamic field we are promoting a "process of change" that will transcend the particular details of today's technologies, analysis tools and data resources. Like other BioQUEST efforts, this project involves supporting a community of faculty and students who are interested in pursuing a vision of biology education that reflects important aspects of biological research. Instead of focusing exclusively on a familiarity with existing knowledge and skill, our approach emphasizes the links between what we already know, the analysis of new data and the research claims we are trying to support. The focus on strategies of research and understanding the relationships between data and claims provides a much more durable knowledge that will serve students better as the discipline continues to evolve. Placed within the context of the 3Ps (Problem posing, Problem solving and Peer persuasion) bioinformatics provides an opportunity to engage students with interesting problems

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Reaching Out, Connecting and Knitting Together (BEDROCK)

that touch on subjects across the spectrum of biology from ecology to molecular biology.

The barriers to the successful integration of bioinformatics into undergraduate education are generally not issues of access to, or mechanical proficiency with, bioinformatics tools. These technical issues are easily addressed with good help files and tutorials. A much more significant barrier to the adoption of bioinformatics is the difficulty relating these emerging techniques to existing biological knowledge and teaching needs. That is, how does someone with expertise in an area like botany or cell biology link the research questions they are familiar with to emerging bioinformatics data resources? Most presentations of bioinformatics emphasize particular computational and mathematics techniques but neglect to ground these in a rich and recognizable biological context.

A major agenda for our project is to address questions like:

- Which biological questions lend themselves to bioinformatic analysis?
- How does one integrate bioinformatics across existing courses instead of creating a stand-alone "techniques" course?
- Which teaching strategies foreground the biological aspects of bioinformatics and integrate the different levels of biological organization with the molecular data?

How to get involved

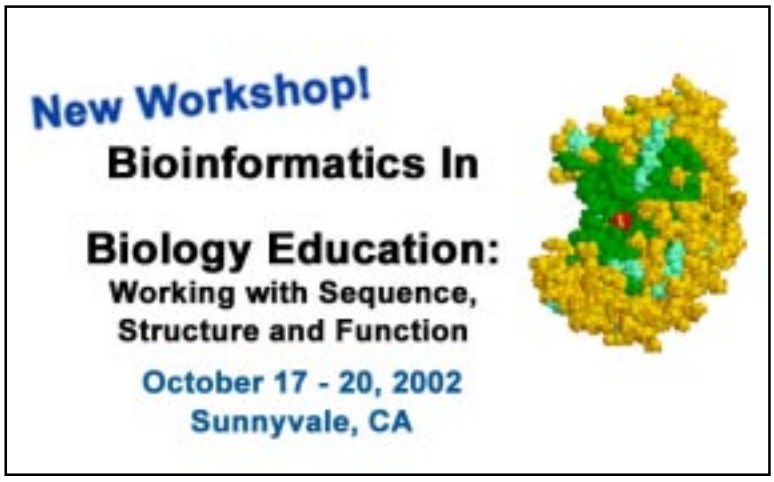
Visit the BEDROCK Project Homepage (*http://bioquest.org/bioinformatics/*) for additional information about the project including information on upcoming workshops, collaborations, and curricular resources. Consider joining our list of interested faculty to make sure you receive regular updates about new workshops and resources as they become available.

Consider joining us in Sunnyvale, California (in the San Francisco Bay area) October 17 - 20, for our next BEDROCK workshop. We are expecting another full house as we meet for four days to discuss the analysis of molecular data to solve problems in medicine, agriculture, conservation and evolution. The presentations and problem-solving sessions will focus on the relationships between evolutionary theory and the analysis of sequence and structure data. We are committed to integrating bioinformatics across the undergraduate biology curriculum in a way that emphasizes the inquiry driven approach captured in BioQUEST's 3 Ps (problem-posing, problem-solving, and peer-persuasion).

The workshop will be led by John Jungck, Sam Donovan and Theresa Johnson from Beloit College with invited presentations by Aviv Bergman from the Center for Computational Genetics and Biological Modeling at Stanford and Stephen Everse from the Department of Biochemistry at the University of Vermont.

This workshop is designed for any biologist or biologically inclined individual who is interested in teaching with bioinformatics. The activities will combine hands-on problem-solving sessions with presentations on the principles of bioinformatics and discussions of how to develop your own teaching materials and sustain professional collaborations in bioinformatics education. Please see the web site for more details on the schedule and information on how to apply.

For more information contact Sam Donovan, donovans@beloit.edu.



Science Education and Civic Engagement: A Strategy for promoting institutional curricular reform

Marion Fass
Beloit College and BioQUEST Curriculum Consortium

BioQUEST has long advocated the study of real problems through case studies and simulations. Some of BioQUEST's most widely used modules, such as Late Blight and Environmental Decision Making build upon rich and real data sets. Other modules such as Epidemiology allow students to build models based on problems and parameters of their choosing. BioQUEST's most recent workshop on Biocomplexity explored the need for science education that focuses on many levels of analysis, from the molecular to the ecological, as students and faculty grapple with complex and unsolved biological issues such as species loss or the emergence of infectious diseases.

Students appreciate the connection between what they learn in the classroom and the issues that they confront in the news. HIV/AIDS, bioterrorism, and citrus canker have joined older problems such as endangered species as issues that can provide the basis for linking knowledge with student experience and interest. These "hooks" provide entry to many of the important concepts in biological education.

The SENCER project, sponsored by the Association of American Colleges and Universities, highlights "Science Education for New Civic Engagements and Responsibilities" as a way of institutionalizing science reform. SENCER provides funding for colleges and universities to send interdisciplinary faculty and administrative teams to the annual SENCER Summer Institute at San Jose in August. This week-long workshop focuses on the development of courses that "connect science and civic engagement by teaching 'through' complex, contested, capacious, current and unresolved public issues 'to' basic science." It also provides an opportunity for curriculum reformers to bring other faculty and administrators from their institutions to a forum where problem posing and problem solving are of central concern.

SENCER provides an important opportunity to move curricular reform in biology from the isolated classroom to a larger arena. SENCER teams must include an administrator with responsibility for curricular issues and a science educator responsible for the education of future teachers. The SENCER approach complements BioQUEST's efforts to include investigative activities into the science curriculum. The workshop and institutional support from AAC&U may help move change into the academic mainstream.

For more information about the SENCER Summer Institute and to review course models from SENCER members, visit their website at http://www.aacu-edu.org/SENCER/. The deadline for applications for an interdisciplinary team to attend the summer 2003 meeting is February 15, 2003.

Workshop

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Ellen Cunningham, another math professor found that the workshop fostered "not only good collaboration, but good integration of science, mathematics and social problems." Flath and Cunningham may not be biologists, but they certainly fit right in with the rest of the folks of BioQUEST. Like so many others, the mix of enthusiasm, creativity and high standards for rigorous content pushed all participants to work hard, share deeply and create strong materials.

The workshop had multiple goals. Participants were to begin to develop a framework for biocomplexity education and explore avenues to integrate biocomplexity into undergraduate education. Additionally, typical of most BioQUEST gatherings, the workshop was also about providing a format for exploring new ideas, sharing teaching strategies and collaborating with professional peers.

Judging from the activity, the workshop seems to have been a success. When the nine-day workshop ended on Sunday, June 23, people left excited about innovative ways to help their

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The BioQUEST Biocomplexity Project: An Update

John and Robin Greenler
Beloit College and BioQUEST Curriculum Consortium

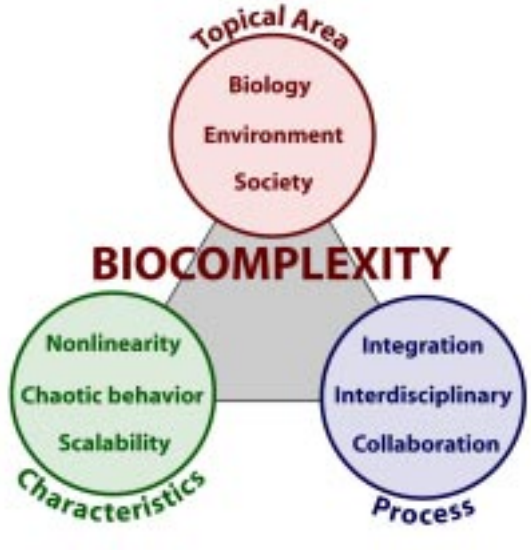
The Biocomplexity Project (*http://bioquest.org/biocomplexity/*) is a new initiative of the BioQUEST Curriculum Consortium. While we continue to consider and hone our sense of the field of biocomplexity (see *BioQUEST Notes*, Spring, 2002), we are also beginning to develop educational materials based on current biocomplexity research. Key goals of the Biocomplexity Project are to 1) collaboratively develop a framework for biocomplexity education, 2) create interdisciplinary, problem-solving materials for undergraduate classrooms, and 3) initiate ongoing collaborations in biocomplexity education.

Biocomplexity (the interactions among the biological, geophysical, and chemical dimensions of ecosystems and human society) is characterized by nonlinear responses, chaotic system behavior, and scalability across spatial and temporal dimensions. As a new field of research, the resources that have been invested in the area of biocomplexity have focused primarily on scientific research and secondarily on translations of that research into education. The challenge in biocomplexity education is to create effective instructional materials, which are pedagogically and scientifically sound and represent contemporary understanding.

The emerging field of biocomplexity research demands collaborative, integrative, and interdisciplinary approaches. These same characteristics—collaboration, integration, and interdisciplinarity—are also hallmarks of contemporary educational reform (Committee on Undergraduate Science Education, 1999). Biocomplexity therefore provides a key opportunity to teach using scientific and pedagogical strategies that are considered contemporary and effective in both domains.

This June more than 40 educators participated in the BioQUEST summer workshop on Biocomplexity entitled *Biocomplexity: From Hard Data to Hard Decisions* (see accompanying article, page 1). Throughout the workshop, participants grappled with developing a sense of what biocomplexity education materials might look like, and how they would be used. Participants developed a wide variety of approaches to translating this complex topic into the undergraduate classroom.

Through workshop participants and others, the BioQUEST Biocomplexity Project is developing teaching strategies for integrating biocomplexity and its multidisciplinary approaches to problem solving into educational materials that are research-rich, integrative, and collaborative.



Biocomplexity can be defined in three different dimensions: 1) the intersecting **fields** of biological, environmental and human realms, 2) the nonlinear, chaotic, and cross scale **nature of the data** and 3) the integrative, collaborative, and interdisciplinary **approach to the research.**

Workshop

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students learn difficult material. Through newly forged collaborations, participants were well on their way to developing classroom ready material.

On Saturday, June 15, after introductions to BioQUEST and biocomplexity, participants took on the role of students as they attended three sessions designed to highlight approaches to biocomplexity research. In the first of these sessions, BioQUEST staff examined spatial data analysis and geographic information systems (GIS) tools with help from scholar-in residence Louis Gross of the University of Tennessee-

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Workshop

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Knoxville. People explored several computer spatial analysis tools ranging from the supermarket variety to high-end professional software packages. Importantly, participants got to try their hand at navigating campus with a GPS unit and explored ways of using GIS technology in the classroom.

A second session, Mathematical Modeling and Computer Simulations benefited from insights of scholar-in residence Claudia Neuhauser of the University of Minnesota. In this session, participants built models that explored various methods of computer modeling from Microsoft Excel spreadsheets to sophisticated simulations such as BioQUEST's Biota. Under Neuhauser's tutelage, participants built computer models based on data collected in the field at the start of the session.

The third session in this portion of the workshop looked at the role of genetic sequence data in addressing a range of problems. Scholars-in-residence Peter Lockhart of Massey University, New Zealand and Margaret Corbit of Cornell University joined the BioQUEST staff to present this mini workshop. Lockhart challenged participants to look at the intersection of distribution and phylogenetic information, phylogeography and to differentiate between dispersal and vicariance hypotheses. Corbit demonstrated the use of Transposon Bank, (*http://www.scicentr.org/exhibits/transposon.asp*), a tool for identifying transposable elements in the rice genome.

Following these sessions, participants worked in small groups to pose and explore questions. Topics such as the causes of pinnateness of honey locust leaves, the economics of biocomplexity, and biocomplexity in a toxic briar patch were all presented in the Monday afternoon poster presentation session.

In the second section of the workshop participants developed classroom materials based on a certain topic, tool, or audience. Presentations throughout the week continued to provide input, ideas and perspectives for the teams as they grappled with how to develop biocomplexity materials. Claudia Neuhauser presented an overview of the work on ecology of perturbed systems being done by the University of Minnesota's biocomplexity project. Peter Taylor of the University of Massachusetts-Boston examined the social dimensions of biocomplexity through a presentation and workshop on case studies and ill-defined problems. Jason Van Driesche of the University of Wisconsin-Madison spoke about biocomplexity of invasive species. Jean Douthwright of the Rochester Institute of Technology addressed the handling of biocomplexity's social issues in the classroom. Marion Fass of Beloit College examined issues of emerging infectious diseases and Yaffa Grossman, also of Beloit College, spoke about her work with fruit growth, *PEACH*, a computer simulation model of the physiological factors affecting fruit growth, and the interaction of those factors with global warming. Finally, Peter Lockhart addressed biodiversity and phylogeography from his New Zealand perspective.

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Workshop

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Perhaps the most fun day of the week for people was the field trip on Tuesday. By 10 AM we were visiting Steve Pincus and Beth Kashmier on their vegetable farm. They spoke about how they, as organic growers, contend with biocomplexity constantly, and have to find ways to use the natural elements on their farm to their advantage. At the next stop, University of Wisconsin-Madison Arboretum's Education Director Molly Murray gave us a tour of the Arboretum's restored prairie. For many, this was a first visit to true prairie, and the excitement was very evident.

While reluctant to leave, hungry stomachs made the next destination appealing. L'Etoile Restaurant was waiting for us in Madison, and Deb Lease greeted us warmly. Here we enjoyed wonderful food from a restaurant that features local foodshed cuisine and often organic ingredients. Jack Kloppenberg of the University of Wisconsin –Madison accompanied the group all morning. Jack's research on food systems and foodsheds helped us put many of the stops into a greater context.

Between the field work, presentations and informal conversations, participants were forming a vision of what they wanted to do for their final project and with whom they wanted to work. While at first it seemed that the schedule provided too little down time, when the final groups were formed, most people were using what little down time there was to do more work.

At the end of the week, participants shared their works in progress. Groups had grappled with issues of teaching biocomplexity and the solutions were as varied as the participants. Participants developed case studies, models, activities, presentations and simulations that addressed introductory to upper level students. Topics included fire ants, Citrus Canker, risk assessment and complexity, whale meat and bioinformatics, tuberculosis, decision making in global and local environments, families of mathematical functions in biology, organic gardening, and Lyme Disease.

While the classroom biocomplexity materials were perhaps the most tangible products of the workshop, as significant were the connections, collaborations and perspectives shared by those attending. "There is a community spirit here that is one of the most valued aspects of my life," says Peter Woodruff. Woodruff is a biology professor and longtime workshop attendee, and he credits much of his academic success to BioQUEST. "It allowed me to influence what is going on at my college," he says, "it allowed the whole department to adopt some level of the 3 Ps. Now we're working on physics and chemistry." Don Buckley, a veteran BioQUEST member,

continues to attend the workshops. "I want to be rejuvenated," he says, "I always get jazzed up when I come to BioQUEST. Now it is visiting brothers and sisters."

It is this family feeling that makes the workshop so much fun amidst all of the hard work. As varied as the participants' backgrounds were, each of them shared common beliefs and goals for their students. All of them want to adopt the "3 Ps" in their classroom or perhaps find new ways to present it.

The workshop was about finding ways to "give students experience in the process of science," as several participants put it. This is one goal that the conference facilitators—the BioQUEST staff—were going to make sure happened.

"My job is to provide a bit of discomfort just when you think you've got it," explains John Jungck. The self-proclaimed "cuddly cactus" made sure he pushed each group to explore all of their options. He determined that each group was going to leave Beloit with something to use in their classrooms.

At its core, BioQUEST's mission is to bring together a community of educators interested in curricular reform with the belief that when convened, such an audience can create together far more than anyone could dream of singly. Those at Beloit during the conference would have agreed with the power of just such collaboration.

Joshua Tusin, is a senior biology major at Beloit College and is the Director of Public Relations for the Journal of Young Investigators.

The BioQUEST Curriculum Consortium

To contribute to the newsletter or to subscribe to *BioQUEST Notes*, please contact Robin Greenler, Editor (greenlrr @beloit.edu). For general information about the activities of the BioQUEST Curriculum Consortium, contact us at:

BioQUEST Curriculum Consortium

Biology Department
Beloit College
700 College Street
Beloit, WI 53511

(608) 363-2743
bioquest@beloit.edu
http://BioQUEST.org

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Beloit College
BioQUEST Notes
Department of Biology
700 College Street
Beloit, WI 53511

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