

Annual Report for Period:09/2004 - 08/2005**Submitted on:** 05/31/2005**Principal Investigator:** Schatz, Bruce R.**Award ID:** 0425852**Organization:** U of Ill Urbana-Champaign**Title:**
FIBR: BeeSpace - An Interactive Environment for Analyzing Nature and Nurture in Societal Roles**Project Participants****Senior Personnel****Name:** Schatz, Bruce**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Robinson, Gene**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Fahrbach, Susan**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Rodriguez-Zas, Sandra**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Zhai, ChengXiang**Worked for more than 160 Hours:** Yes**Contribution to Project:****Name:** Bruce, Bertram**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Project Lead for Education and Outreach.

Senior graduate student in education supported on grant, plus summer salary for Biology Teacher at University Laboratory High School.

Post-doc**Graduate Student****Undergraduate Student****Technician, Programmer****Other Participant****Research Experience for Undergraduates****Organizational Partners**

Texas A&M University Main Campus

CORNELL UNIVERSITY

University Laboratory High School

Other Collaborators or Contacts

Chris Elsik, Department of Animal Sciences, Texas A&M University

Janet McCue, Mann Biology Library, Cornell University

David Stone, University Laboratory High School

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

See attached file with details.

Findings:

Training and Development:

We have been holding weekly lab meetings this year to train the graduate students in computer science and in biological science working on this project. 15 persons intermixed between disciplines have been regularly attending. For list of topics and slides, see <http://www.beespace.uiuc.edu> under Groups under BeeSpace.

Outreach Activities:

This year we are hosting our first annual workshop at the Institute for Genomic Biology at the University of Illinois. This will be held June 6-7, see <http://www.beespace.uiuc.edu> for details. We are expecting 80 persons including 15 from external collaborator sites. Overview talks will be given to share information to the campus and elsewhere about our progress. Biology graduate students from our early adopters sites will test drive our initial system prototypes. The teams for informatics, biology, education will meet in breakout sessions to review progress and plan for next year activities.

Journal Publications

G.E. Robinson, C.M. Grozinger, C.W. Whitfield, "Sociogenomics: Social Life in Molecular Terms", Nature Review Genetics, p. 257-270, vol. 6(4), (2005). Published

Gene Robinson, "Beyond Nature and Nurture", Science, p. 397, vol. 304, (2004). Published

Books or Other One-time Publications

Web/Internet Site

URL(s):

<http://www.beespace.uiuc.edu>

Description:

The project website. created this first year.

Contains detailed information on the background behind the project.

Contains slides and videos of the lectures given during the project.

Other Specific Products**Product Type:****Audio or video products****Product Description:**

Overview Talks about the BeeSpace project.

Also specific planning talks about specific parts.

Sharing Information:

Freely available at project website

<http://www.beespace.uiuc.edu>**Contributions****Contributions within Discipline:**

coPI Gene Robinson was elected to the
National Academy of Sciences
in the section on Evolutionary Biology

Contributions to Other Disciplines:**Contributions to Human Resource Development:**

Established Bioinformatics Laboratory in
new Institute for Genomic Biology at the
University of Illinois at Urbana-Champaign

Contributions to Resources for Research and Education:

the various informatics investigators
(Schatz, Zhai, Rodriguez-Zas) have helped
establish a new Master's degree program in
Bioinformatics at the University of Illinois

Contributions Beyond Science and Engineering:

coPI Gene Robinson published an OpEd piece in the New York Times about Nature-Nurture, a popular version of the project topic.

Special Requirements**Special reporting requirements:** None**Change in Objectives or Scope:** None**Unobligated funds:** \$ 1,200,000.00**Animal, Human Subjects, Biohazards:** None**Categories for which nothing is reported:**

Activities and Findings: Any Findings

Any Book

Contributions: To Any Other Disciplines

Research and Education

This year was the first year of our project funding. We largely were in organizational mode, but made substantial progress in planning activities.

The major thrust of the project is in its bioinformatics, specifically developing an interactive environment for functional analysis. This year, we established the Bioinformatics Laboratory in the temporary space for the Institute for Genomic Biology. Its new building in the heart of the University of Illinois campus will open in summer of next year and as the first Institute flagship, we will be situated in the central location of the building. We held weekly meetings in the Bioinformatics Laboratory to plan the initial systems prototype for the BeeSpace environment, with 15 graduate students and faculty from computer science, integrative biology, and statistics. We also hired a senior programmer for software development, who had 12 years of experience as lead programmer in text processing information retrieval projects for scientists, and a project coordinator for education/outreach.

The first prototype of the BeeSpace environment is just now being readied for our first annual project workshop to be held June 6-7. We plan to have the biologists (grad students, postdocs) from our early adopter group (5 labs studying bee and fly) test drive the prototype to get feedback on its functionality. It supports conceptual navigation across community collections, as promised in our proposal. But the functionality is primarily to show our early users what is possible to gain feedback for the first fully fledged system to be developed next year.

A dozen sample community collections have been generated from Biological Abstracts that partition the scientific literature in different ways across organism (bee, fly), method (chemistry, physiology), behavior (foraging, agonism), and so on. These collections have been semantically indexed, using our phrase parser to extract concepts and our statistical clustering to group together related concepts. Users can navigate from concept to concept, then view the corresponding documents. We also have built initial links into the genome databases through gene names, using FlyBase as a model organism database. The goal is to enable easy navigation from high-level concepts from one viewpoint to low-level concepts in another viewpoint, and thence into genomic data.

We spent significant time this year, giving overview talks to organize the project and inform the community. See slides and videos available on our project website at www.beespace.uiuc.edu under Resources under Talks.

The biology research was originally to be the major activity this year, while the informatics research was in planning phase. Its primary thrust is to record microarray expressions for social behavior of honey bees, across all the normal activities in naturalistic settings. But fabrication of the microarrays relies on having the genome sequences available, being carried out under NIH funds at Baylor. This separate leveraged sequencing was delayed beyond original projections. It is now complete, but the delay meant that the biology experiments were not run this year, but pushed into next

year. This additional time did give us significant time to more carefully plan the expression experiments.

coPIs Robinson and Schatz particularly spent significant time discussing different strategies for the master list of societal roles to be studied. This period was quite helpful, as we have now moved from a fairly standard behavior list for social insects into a detailed list of nature/nurture components for social behavior. In particular, we will concentrate on foraging behavior under a number of environmental conditions, including hive starvation and adverse climate. This will potentially enable us to use the expression functions for comparative analysis across insects, such as the fly model. We also will concentrate on defensive behavior under different environmental conditions, such as different levels of hive threats. This will potentially enable us to use the expression functions for comparative analysis into rodents, such as the mouse model.

Special Requirements

Because the primary activity was planning this first year, we have substantial unobligated funds. The PI (Schatz) has significant experience in running large NSF systems projects and this pattern is quite typical. The planning years underspend, but the development year overspend, as the project ramps up with real systems and real users. So we appreciate the flexibility of NSF in permitting us to responsibly spend the funds as the needs of the project dictates.

This year about 1/3 of our budget or \$400K was spent, yielding \$800K not spent. This was primarily due to 3 unanticipated circumstances: (1) The sequencing of the honey bee genome was delayed so the \$300K for expression experiments was postponed to next year (\$150K for microarrays and \$150K for technician and student support), (2) We were careful hiring the full-time staff to get quality people for the entire 5-year project run so the senior programmer hired in second half of this year and the junior programmer deferred to next year hiring, postponing \$200K monies, (3) the NSF allocation this year was \$100K more than we budgeted in our request.