

Education

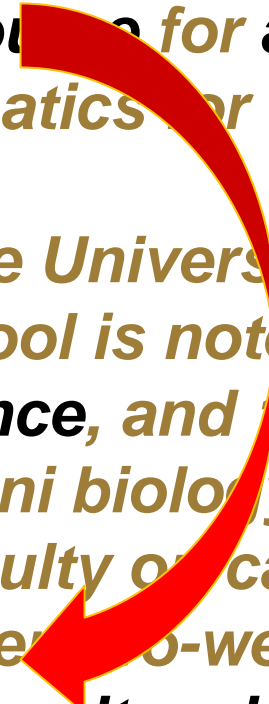
BeeSpace 5th Annual Workshop
Institute for Genomic Biology
University of Illinois at Urbana-Champaign



WAKE FOREST
UNIVERSITY

Urbana, IL | MAY 22, 2009

- ***Students learn best when they are engaged in authentic scientific inquiry.***
 - ***The goal is to target available resources to high school and college students prepared to make use of the opportunity.***
 - ***We will involve younger students in BeeSpace in the context of a stimulating but nurturing summer camp environment supportive of inquiry and intellectual growth.***
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- *The undergraduate component will be based at Wake Forest University...Fahrbach will design and teach an entirely new BeeSpace-inspired course for advanced undergraduates, called “Bioinformatics for Beginners.”*
 - *BeeSpace will exploit access to the University Laboratory High School...The school is noted for a long tradition of academic excellence, and 100% of Uni students attend college. The Uni biology teacher, David Stone, has strong ties to faculty on campus.*
 - *In years 2 and 4, BeeSpace will offer two-week-long biology summer day camps for minority middle school students.*
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Accomplished

Multiple minor “meet a bee” events

Ongoing development of materials by David Stone

Three offerings of Bioinformatics for Beginners at WFU by Fahrbach

Two one-week summer camps for selected upper middle school students (group effort!)

Creative documentation of research goals, methods by Buell

Not accomplished

Sustained use of inquiry approaches

Involvement of minority students

WFU course for first year students, not majors

Interaction of WFU students & summer campers

Pending

Creation of online archive for BeeSpace educational materials

Articles in biology teaching journals

- **incorporation of BeeSpace materials into pre-existing institutional frameworks**
 - e.g. WFU First Year Seminar Program
 - **reliance on resources controlled by BeeSpace participants**
 - e.g. use of Bee Research Facility, IGB classrooms, Uni students
 - **hiring an education coordinator (Jim Buell)**
 - e.g. allowed continuity in education efforts
 - **outstanding contributions by graduate students (and others) interested in outreach**
 - e.g. BeeSpace created an environment in which education and outreach were rewarded
 - **flexible attitudes on part of BeeSpace educators**
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- **failure to build needed institutional frameworks**
 - e.g. no direct links formed between BeeSpace and Don Moyer Boy's and Girl's Club
 - **reliance on resources NOT controlled by BeeSpace participants**
 - e.g. summer math camp “disappeared” between time proposal was submitted and time funding became available
 - **conflicts between research and educational goals**
 - e.g. summer time is a valuable and limited resource
 - **narrow vision of BeeSpace educational component**
 - e.g. too focused on biology? missed opportunities in computer science, bioinformatics?
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Summer camps at UIUC



“In April 1995, the College of Arts and Sciences faculty approved the First Year Seminar (FYS) Program, recommending that each seminar include “intense intellectual interchange, both written and oral, in a seminar setting in which all participate ...in critical thinking and analysis of arguments. [Seminars] should include discussion and debate on issues, examination of opposing viewpoints ...and written and oral assignments that force students to make explicit their ideas and thoughts...”

“First Year Seminars, which enroll 15-19 students per section, are taught by faculty from all academic divisions and ranks. Every First Year Seminar is topical and constructed by the individual faculty member with the guidance stated above. A standing faculty committee receives and approves each FYS proposal. Content is approved, in advance, by the appropriate department chair or dean.”

2008-2009 offerings included: Wagner’s Ring, The Bildungsroman, God, Genius, The Great Neglected Diseases of Mankind, Psychological Utopias, Technical Analysis of Stocks & Options, the Mathematics of Voting, and Bioinformatics for Beginners

- **20 pages minimum writing**
 - **oral presentations**
 - **assigned readings**
 - **class discussion (including student-led)**
 - **group projects expected**
 - **support from library staff**
 - **support from IT staff**
 - **service component considered desirable**
 - **all students have ThinkPad laptops**
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Nature vs. Nurture: Bioinformatics for Beginners

Why do animals such as honey bees and humans do what they do? How do genes and environment interact to control behavior? The developing field of bioinformatics provides new approaches to long-standing questions in biology. This course will provide a hands-on introduction to the use of computer-based bioinformatics tools. Within a framework provided by social insect biology, students will conduct original *in silico* experiments and share their writing about the results of their analyses with their classmates and, in some cases, with the developers of the software tools they use. Students will gain experience in the generation of hypotheses and creative use of computer-based bioinformatics tools while honing their essay-writing skills.

Use of PubMed

Use of NCBI

Use of Swiss-Prot/Expasy

Use of BeeSpace Navigator

Use of basic bioinformatics tools (BLAST, Dotlet, simple tree-building programs)

Reading and discussing current writing on nature and nurture (Pinker, Sapolsky, Ridley)

Introduction to use of on-line resources by the WFU science librarian

Evaluation of BeeSpace materials

Video conferences with Schatz, Robinson, BeeSpace Pis

Weekly essays/creation of PowerPoint slides

Observations of bees, honey tasting

Development of novel teaching materials, web sites

Most students had studied AP biology, but did not understand the central dogma

Students struggled with the concept of gene expression

Students tended to seek nature vs. nurture types of explanations, or become “holistic interactionists”

Most students could not sustain interest in bee behavior

Undergraduates were able to develop and create prototypes of teaching materials for younger students (middle school and high school)

Most students loved the NCBI tools and showed a good grasp of the application of the concept of “similarity”

When “liberated” in 2009 to choose human examples, student groups created effective web sites annotating articles from the primary literature on the causes of behavior

Effective BeeSpace materials included “Annotation of a BeeSpace Experiment,” interview with Nick Naeger, and presentation by Bruce Schatz to campers

[Are Leaders Born or Made?](#)

[Understanding Causes of Borderline Personality Disorder](#)

[Exploring Sleep Terrors](#)

[Shyness, BI, and the 5-HTTPR Genotype](#)

[Genes & Athletic Ability](#)

BeeSpace stimulated novel educational projects

BeeSpace created materials that may have lasting value

bee behavior (model organism) is a tough sell to undergraduates who are not biology majors

bioinformatics (and NCBI in particular) is not a tough sell to non-majors

the device of asking undergraduates to teach others what they “understand” created opportunities to diagnose gaps in their own understanding

NSF
WFU
UIUC



Honeybee songs
performed by Kurt
Mahnken, Aaron Payne,
and Jose Domenech
(WFU 2011)

