



BioBus Educational Programs

On Wheels and in the Classroom

Annual Report 2007-2008

“To be a key bioscience education resource in Connecticut, igniting enthusiasm, understanding, and support for science and technology”

A WORD FROM THE DIRECTOR OF BIOBUS EDUCATIONAL PROGRAMS



This has been an exciting year for the BioBus Educational Programs (the BioBus). Over the past six years, the BioBus has achieved accomplishments far beyond its initial goals, and has created a unique model that is effective, and is being used by others nationwide.

We now hope to realize a new vision, to move from an enrichment of science education, to be part of a new paradigm that will raise Connecticut math and science proficiency.

Towards this new vision, we have developed a new mission: “To be a key bioscience education resource in Connecticut, igniting enthusiasm, understanding, and support for science and technology.” Towards this new mission, we have outlined three central goals outlined in the box below.

This year, the BioBus Board of Directors officially approved an ambitious five-year strategic plan aimed at achieving this new mission, impacting each level of bioscience education in Connecticut. We have worked hard to secure funding for this strategic growth and I am pleased to announce we have secured over \$2.6 million towards these initiatives.

The information contained in this report confirms that there is a great need for quality science education programs in Connecticut, and that the BioBus Educational Programs is eloquently poised and motivated to be a key bioscience education resource for the State.



Goals

- *To provide comprehensive, state-of-the-art and interactive bioscience experiences for students, teachers, and the general public*
- *To serve as a nexus for knowledge transfer between formal science learning, higher education, and industry*
- *To encourage students to pursue science careers*

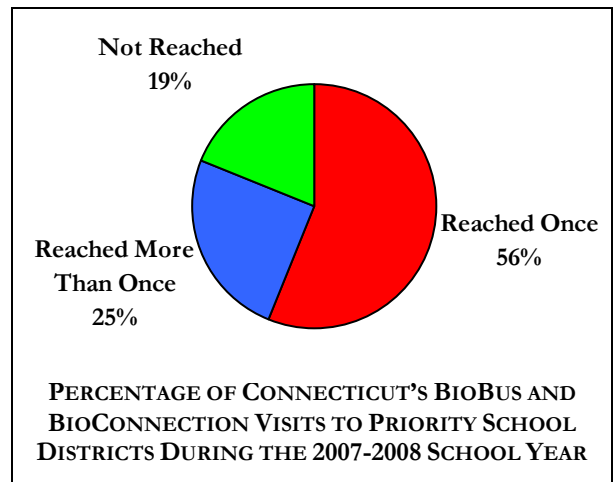
MEETING CONNECTICUT’S NEEDS

As the role of science and technology in society increases, so does the need for an educated populace capable of fulfilling the industry’s highly skilled jobs, and making informed decisions related to science and health care. However, Connecticut has large achievement gaps in science. Connecticut students are neither proficient in science nor pursuing degrees in science. Clearly the time is right to substantially expand the depth and breadth of the highly successful BioBus Educational Programs. Biotechnology education is becoming an integral component of science education in the 21st century to meet the demands for a qualified biotechnology and health care workforce of the future, and to empower students to become responsible consumers of science.

Priority School Districts

Each year the Connecticut State Department of Education recognizes specific school districts with the greatest needs. These school districts are referred to as Priority School Districts. In order to serve areas with the greatest needs, State designated Priority School Districts are taken into consideration when Program visits are scheduled. For the 2007-2008 school year:

- As a whole, the BioBus Educational Programs reached 81% of the designated Priority School Districts, almost 20% increase over last year
- 32% of the public schools visited by Connecticut’s BioBus were to Priority School Districts
- 38% of the public schools visited by BioConnection were to Priority School Districts
- Of those Priority School Districts reached, 56% of them were reached more than once by a Connecticut’s BioBus and/or BioConnection visit

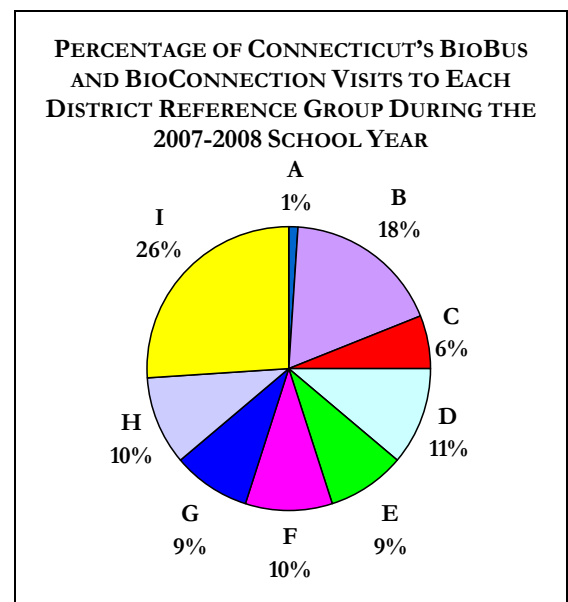


District Reference Groups

The Connecticut State Department of Education has categorized all districts into one of nine groups, serving to partner districts with similar socioeconomic status, enrollment and needs. These groups, or District Reference Groups (DRGs), were developed to assist in reporting and analyzing school district data.

The DRGs are alphabetically designated, with the most affluent districts designated DRG A, and the most needy districts designated DRG I. For the 2007-2008 school year:

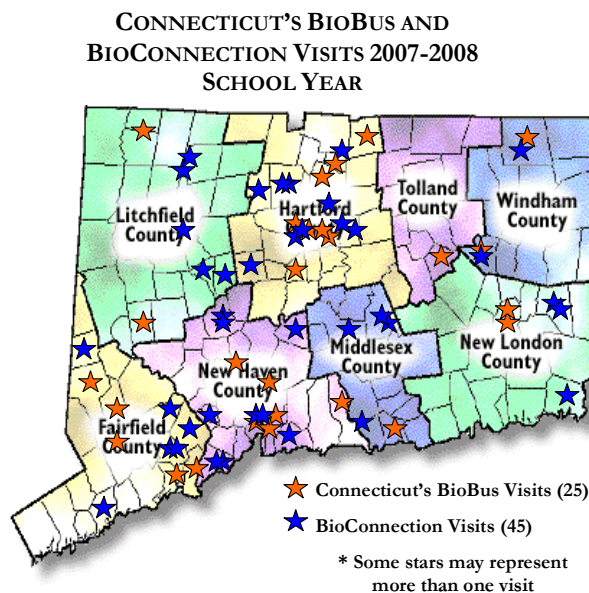
- Needy school districts received the largest number of combined visits from Connecticut’s BioBus and BioConnection programs.
- All DRGs were successfully visited by the BioBus Educational Programs this year
- 32% of the schools visited by Connecticut’s BioBus were DRG I schools
- 22% of the schools visited by BioConnection were DRG I schools



CONNECTICUT'S BIOBUS AND BIOCONNECTION

In its seventh year, Connecticut's BioBus has had its usual busy schedule of visits to elementary, middle, and high schools throughout Connecticut, beginning in New Haven in September and winding up in Enfield in June. During the 2007-2008 school year, Connecticut's BioBus visited 25 Connecticut schools, reaching approximately 2,000 students. In addition to the school visits, Connecticut's BioBus was actively involved in many public events, reaching thousands of people with hands-on bioscience experiences. Requests for school visits during the year continued to exceed current program capacity, and there is now a four year waiting list for Connecticut's BioBus.

In February 2008, Connecticut's BioBus was upgraded with a new audiovisual system which included the installation of SMART Technology interactive learning tools, which has streamlined and enhanced the teaching and learning of bioscience experiments. These improvements were made possible through the collaboration with SMART Technologies, Inc, whom will also be designing the new graphics for the outside of Connecticut's BioBus to be installed in September 2008.



As of June 2008, Connecticut's BioBus and BioConnection Programs have:

- Visited over 515 schools
- Reached over 64,000 students
- Trained over 960 teachers

BioConnection, our equipment loan program, visited 45 schools this year, beginning with a visit to Trumbull in October, and ending with a visit to East Hampton in May. In total the BioConnection program reached approximately 6,000 students, an increase of over 1,000 students from last year.

STUDENT IMPACT

This year the BioBus staff worked with the BioBus Educational Programs Advisory Council to design and implement student pre- and post- laboratory assessments for each of the BioBus curriculum units with the aim of assessing changes in student science content knowledge as well as attitudes towards science. The assessments were piloted with plans for systemic implementation in the 2008-2009 academic year. The following data was received during the pilot (372 students participated):

- Participation in the BioBus/BioConnection experience increased student science content knowledge by 21%.
- 67% of students really enjoyed the BioBus/BioConnection experience
- 34% of students felt the BioBus/BioConnection experience made them more interested in science

BIOSCIENCE CURRICULA

In partnership with the Connecticut Department of Education, the BioBus staff wrote a curriculum-embedded performance task to prepare third grade elementary students for the science portion of the Connecticut Mastery Test. The task, *To Drink or Not to Drink*, provides a context to discuss water, highlighting that water is a non-renewable resource to be conserved. Through a series of hands-on, inquiry-based experiments, students also learn about water quality and purification. *To Drink or Not to Drink* will be officially rolled out by the Connecticut Department of Education and the BioBus in the 2008-2009 school year.

“Teachers rated the BioBus Educational Programs curricula and technologies as tightly aligned with current classroom curriculum”

(mean response 9.5 on 10 point scale with 10 being the highest, with 94% of teachers at highest levels)

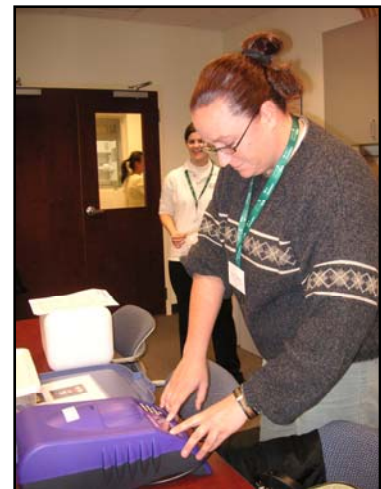
This year the BioBus expanded a partnership with Invitrogen Corporation to develop a new high school level experiment on cancer biology. This experiment will utilize proteomics and genomics to study the formation, treatment, and prevention of cancer. The BioBus staff will continue working with Invitrogen scientists over the upcoming year to complete, pilot, and implement this new experiment as a permanent addition to the BioBus Educational Programs curricula.

While many new exciting partnerships were formed this year, an especially intriguing one was a collaboration with Wesleyan University and the Liz Lehrman Dance Exchange to develop and implement parts of their theatrical production *Ferocious Beauty: Genome* as an alternative means to teach genetics concepts in the classroom. This collaboration will continue over the next five years due to support from the Howard Hughes Medical Institute.

TEACHER PROFESSIONAL DEVELOPMENT

The BioBus Educational Programs’ comprehensive teacher professional development program was busy as ever training 186 teachers at workshops generously hosted throughout the year by Quinnipiac University.

This year the BioBus staff implemented pre- and post- workshop evaluations to assess changes in teacher science content knowledge as well as teacher confidence in teaching science content and implementing biotechnology in the classroom. As shown, the BioBus workshops significantly increased teacher bioscience content knowledge on average by 36%. Teacher confidence levels in teaching bioscience were also increased on average by 30%, and confidence levels in using biotechnology in the classroom were increased on average by 36%.



THE BIOBUS EDUCATIONAL PROGRAMS SIGNIFICANTLY INCREASE TEACHER SCIENCE
CONTENT KNOWLEDGE, AND CONFIDENCE LEVELS IN TEACHING SCIENCE, AND USING
BIOTECHNOLOGY IN THE CLASSROOM

Program Workshop	Percent Increase	Number of Participants
BioBus Gel Electrophoresis Workshop		
Teacher Science Content Knowledge	50%	36
Teacher Confidence Teaching Science Content	35%	38
Teacher Confidence Using Technology in Classroom	45%	38
BioBus Advanced Experiments Workshop		
Teacher Science Content Knowledge	35%	20
Teacher Confidence Teaching Science Content	20%	12
Teacher Confidence Using Technology in Classroom (p= 0.07)	20%	10
BioConnection Gel Electrophoresis Workshop		
Teacher Science Content Knowledge	38%	10
Teacher Confidence Teaching Science Content	30%	27
Teacher Confidence Using Technology in Classroom	40%	27
BioConnection PCR Workshop		
Teacher Science Content Knowledge	20%	8
Teacher Confidence Teaching Science Content	35%	16
Teacher Confidence Using Technology in Classroom	38%	16

* Unless otherwise noted, all results are statistically significant with p= <0.05

EVENTS, AWARDS, AND PUBLICITY

Connecticut's BioBus appeared at the Connecticut Science Teachers Association (October 2007) where BioBus staff presented a hands-on workshop entitled *Bugs and Scrubs: Teaching Disease Concepts in the Classroom*.

In March 2008, the BioBus staff presented two workshops at the National Science Teachers Association annual meeting in Boston: *Biotech Goes Green*, and *Bugs and Scrubs: Teaching Disease Concepts in the Classroom*. A partnership with SMART Technologies, Inc., permitted Connecticut's BioBus to be on the exhibit floor at the national meeting. Thousands of educators visited Connecticut's BioBus, and BioBus staff lead visitors through a hands-on experiment entitled the *Art of Forgery*.



Also in March, Connecticut's BioBus traveled to the Connecticut Science Fair where director Dr. Sarah Berke presented the CURE Award for Research Excellence in Life Science to one middle and one high school student.

In April 2008, BioBus staff worked with the Connecticut Business and Industry Association on a health and biosciences career pathways project. The BioBus Educational Programs, and more specifically Connecticut's BioBus, were highlighted as an education outreach resources for participating in hands-on

bioscience experiments. The DVD developed will be distributed statewide to encourage students to pursue science careers, and will be available online sometime next year. Also in April, Connecticut's BioBus appeared at the Capitol in Hartford to participate in "Bring Your Child to Work Day" and to showcase its newly installed SMART Technology interactive learning tools. The BioBus staff was joined by students from Wilbur Cross High School in New Haven, who participated in *Genetically Modified Organisms* onboard Connecticut's BioBus.



In May 2008, Connecticut's BioBus traveled to Storrs to participate in the Connecticut Invention Convention where visitors performed a hands-on bioscience experiment. Also in May, BioBus staff served on the Connecticut Career Choices Biotechnology Review Panel at the Connecticut Innovation Expo.

STAFFING, FACILITIES, AND GOVERNANCE

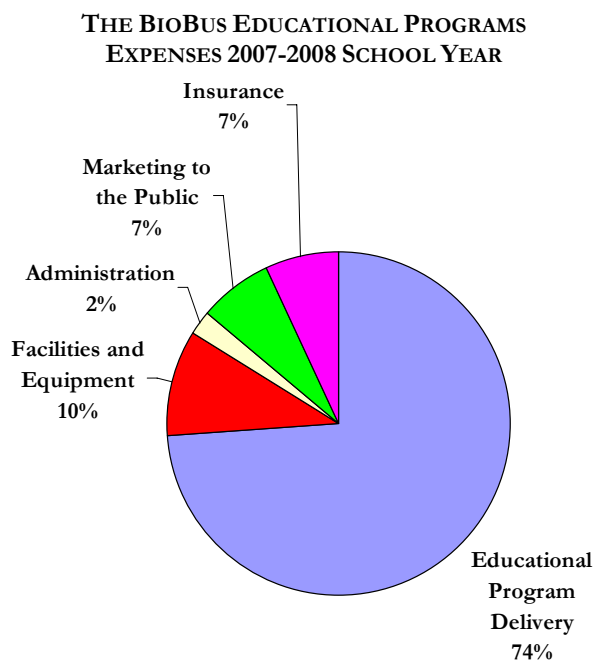
During the period, there were no significant staffing changes. The BioBus employed an intern from the University of New Haven, a female graduate student in Molecular Biology. The intern taught onboard Connecticut's BioBus and in BioConnection classrooms. The office space for the BioBus was shared with CURE at 300 George Street in New Haven. Laboratory space at 300 George Street was provided through the generosity of Achillion Pharmaceutical, Inc.

The Honorable Michael Meotti joined the BioBus Educational Programs Board of Directors, replacing The Honorable Valerie Lewis whom retired as the Commissioner of Higher Education this year. The BioBus Board approved the strategic plan for growth of the BioBus Educational Programs.

FUNDING AND SPONSORSHIP

BioBus Educational Programs has outlined a budget of roughly \$3 million over the next three years to achieve an ambitious plan for strategic growth. In November 2007, the State of Connecticut designated \$1.5 million of bond money for the BioBus Educational Programs to assist with this effort.

The BioBus continued to cultivate a partnership with Boehringer Ingelheim Pharmaceuticals, Inc. securing a commitment of \$1.1 million over the next three years to support elementary science education outreach programs. Additionally, the BioBus generated new partnerships for strategic growth with organizations such as the Connecticut Office of Workforce Competitiveness, SMART Technologies, and United Illuminating, Inc.



CURE AND THE BIOBUS EDUCATIONAL PROGRAMS

CURE (Connecticut United for Research Excellence, Inc) is the leading organization for promoting life science initiatives throughout the state of Connecticut. CURE's award-winning BioBus Educational Programs, "the BioBus," is a critical outreach service consisting of four parts: 1) a mobile science laboratory (Connecticut's BioBus); 2) an equipment loan program (BioConnection); 3) custom-developed curricula; and 4) teacher professional development.

Annually, the BioBus provides hands-on experiment opportunities to thousands of Connecticut students in grades 4-12. The BioBus' statewide reach provides equal access for all students to rich bioscience learning experiences. The BioBus programs are offered free of charge thanks to the continuing support of sponsors over the past six years. The BioBus' close connections with industry and higher education allow it to serve as a conduit between these organizations and K-12 education, permitting it to quickly incorporate state-of-the-art bioscience experiences and technologies for Connecticut. It is this consistency and flexibility that allows the BioBus to remain a leading bioscience education resource in Connecticut.

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