CONNECTICUT

Sciences & Life Sciences Achievement

STUDENT ACHIEVEMENT

NAEP Grade 8	CT	U.S. Avg.	State Rank
Science Average, 2005	151.9	147.1	22
Science, 2005 (% at or above "proficient")	32.8%	27.3%	19
Life Sciences Average, 2005	152.9	148.2	21

ACT	CT	U.S. Avg.	State Rank
Science Average, 2008	22.3	20.8	5
Biology, 2008 (% of students ready for college level)	40%	28%	2

AP	CT	U.S. Avg.	State Rank
Science Scores, 2008 (% with a score of 3 or higher)	71.2%	55.4%	1
Science Exams, 2008 (Exams as % of all H.S. grads)	14.0%	10.5%	5
Biology Scores, 2008 (% with a score of 3 or higher)	68.0%	49.8%	1
Biology Exams, 2008 (Exams as % of all H.S. grads)	5.8%	4.6%	8

SCIENCE TEACHER QUALITY and PROFESSIONAL DEVELOPMENT	CT	U.S. Avg.	State Rank
Science Teachers with Major in Assigned Field, 2003–04 (%, Grades 7–12)	71%	77%	35
Science Teachers Certified, 2006 (%, Grades 7–8)	62%	N/A%	18
Biology Teachers Certified, 2006 (%, Grades 9–12)	99%	88%	6

Note: NAEP = National Assessment of Educational Progress, AP = Advanced Placement
N/A = Data not available.

Key Organization(s) Promoting Bioscience Education

CURE (Connecticut United for Research Excellence) is the leading organization for promoting life science initiatives in Connecticut. Its BioBus Educational Programs promotes bioscience education through four activities:

- A mobile science lab (Bio-Bus)
- A laboratory equipment loan program (BioConnection)

CT STATE SCIENCE STANDARDS & REQUIREMENTS

STANDARDS PROFILE

- Most recent update of K-12 Science Standards: **Prior to 2005**; No current plans to update
- Next scheduled update: None currently planned
- Research scientists provided input in developing standards
- Science standards specifically mention applied laboratory or other tools for biotechnology or biosciences
  - Connecticut's science standards are organized around 11 conceptual themes, one of which is *Science and Technology in Society – How do science and technology affect the quality of our life*, which includes a section on biotechnology. At the 9th and 10th grade level the standards are organized around five strands, two of which focus on life sciences: Cell Chemistry and Biotechnology, and Genetics, Evolution and Biodiversity.

BIOSCIENCE-RELATED GRADUATION REQUIREMENTS:

Biology is not required for graduation

- Custom-developed curricula
- Teacher professional development.

These initiatives are discussed below.

Examples of Bioscience Education Activities

Teacher Preparation and Professional Development

Southern Connecticut State University offers a Masters of Science degree in biology that can include certification for elementary, middle and secondary school teachers.

Connecticut's Biobus teacher professional development program currently trains more than 180 teachers annually through workshops that provide in-depth content knowledge, hands-on learning experiences, curriculum, and all the resources needed to teach key life science concepts in the classroom. While originally designed to train teachers to use Connecticut's BioBus or BioConnection programs, today these professional development opportunities have been expanded to provide assistance to teachers and school districts, as they improve proficiency in bioscience and integrate biotechnology curricula in the classroom.

CT Career Choices (CCC) is a workforce development initiative focused on the implementation of curriculum aligned with both industry and state standards that can be adapted to any high school within Connecticut. With support from state-wide partners, CCC has developed and is implementing industry standards-based curriculum and experiential learning opportunities designed to prepare a workforce ready to meet the demands of 21st century careers. While CCC initially focused on IT careers and curriculum, a curriculum for health and medical careers (HMC) is currently being developed. Once completed, the HMC sequence will be piloted and subsequently made available to all schools. This school year, 13 teachers will pilot a newly developed biotechnology course—BIO 21—in their biology classes, impacting over 500 students. BIO 21 meets all state-established standards for 10th grade biology in the context of 21st century biotechnology. is a workforce development initiative focused on the development and implementation of science, technology, engineering, and mathematics (STEM) curricula aligned with both industry and state standards that can be adapted to any high school within Connecticut. With support from statewide partners including the state's Office for Workforce Competitiveness, CCC is implementing curricula delivered in a blended learning environment (online and in the classrrom) and experiential learning opportunities designed to prepare a workforce to meet the demands of 21st century careers. CCC is managed by the Center for 21st Century Skills at EDUCATION CONNECTION. While CCC initially focused on information technology careers and curricula, it has expanded to e-commerce and entrepreneurship, biotech research and development, and digital arts and sciences curricula. An introductory course for health and medical careers (HMC), entitled Foundations of Health Science and Technology, is currently being further developed into a career ladder with articulation to established 2-year associate-in-arts degree programs in the statewide community college system. Students taking the course will receive three college credits. Once completed, the HMC sequence will be piloted and subsequently made available to all schools. This school year, 13 teachers are piloting a newly developed biotechnology course—**BIO 21**—in their biology classes, impacting more than 500 students. BIO 21 meets all state-established standards for 10th grade biology in the context of

21st century biotechnology. Also under development is a nanotechnology high school curriculum that draws from a newly developed statewide nanotechnology curriculum at the undergraduate level. Student teams participating in these various courses present their projects in a statewide competition at the CT Student Innovation Expo in May of each year.

Connecticut Science Center (scheduled to open in June 2009) currently offers professional development in inquiry-based learning and teaching by providing a series of week-long immersion workshops; called the Institute for Inquiry. These workshops help educators practice teaching techniques and prepare them to incorporate these strategies into their lesson plans and school curricula for the coming year.

DNA EpiCenter, located in the Connecticut College Arboretum, offers hands-on, inquiry-based bioscience professional development workshops for K-12 educators.

The Alternate Route to Teacher Certification (ARC) is an authorized teacher preparation program that was created in 1988 to attract mid-career adults into the teaching profession, particularly in subjects with a shortage of teachers. Individuals are required to participate in training and a student teaching experience. Admission to ARC is competitive and requires a minimum of a bachelor's degree and an academic major in the subject the individual wishes to teach, along with other application criteria. All applicants must have passed the Praxis I examinations or have received a waiver based on past tests such as the Scholastic Assessment Test (SAT) or the Graduate Record Examination (GRE).

Experiential Learning and Outreach

The **Connecticut BioBus** is a 40-foot, custom-designed mobile laboratory delivering hands-on bioscience experiments to more than 5,000 students throughout Connecticut each year. Outfitted with the latest in bioscience equipment and technology, the BioBus provides hands-on experiential learning experiences for students in the 4th through 12th grades. The BioBus accommodates two instructors and up to 24 students at a time. The BioBus visits Connecticut schools free of charge, though each visit requires an investment of time and effort by teachers and the school, including (1) participation in teacher training; (2) integrating the BioBus visit into classroom lessons, along with running activities before and after the BioBus visit; and (3) assisting BioBus staff in teaching on board the BioBus.

The **Bioconnections Program** is an equipment loan program that enables teachers throughout the state to bring sophisticated biotechnology to their classrooms, using the same equipment typically found in modern laboratories. BioConnection equipment, training, and curricular materials are provided free of charge to all schools in Connecticut. The program reaches approximately 10,000 students annually.

As an integral component to all curricula, **CCC** arranges classroom visits/speakers, company visits/tours, job shadowing experiences for students, and teacher externships.

DNA EpiCenter offers hands-on, inquiry-based bioscience experiments and museum exhibits for students in grades K-12 and museum exhibits and educational seminars to educate the general public about current events relating to DNA.

Bioscience-focused Schools and Programs

The **Sport and Medical Sciences Academy** in Hartford is a college preparatory middle and high school, with a focus on medical and sport sciences. Students receive a rigorous language arts, mathematics, and science foundation that is applied in core curricula and various electives. Several college credit programs are offered through both the University of Connecticut's Early College Experience Model and Capital Community College.

The Sound School Regional Vocational Aquaculture Center is one of the 19 vocational agriculture centers in Connecticut and a part of the New Haven Public School System, offering concentrations in the study of aquaculture and marine trades.

The **Bridgeport Regional Vocational Aquaculture School** also offers concentrations in the study of aquaculture and marine trades. Connecticut's aquaculture programs were the focus of last year's national meeting of career and technical education leaders, held at the Bridgeport Aquaculture School September 7 through 11, 2008.

Basic Skills Achievement and Other Summary Metrics

STUDENT ACHIEVEMENT

NAEP Grade 8	CT	U.S. Avg.	State Rank
Math Average, 2007	282.5	280.2	28
Math, 2007 (% at or above "proficient")	34.7%	31.0%	21
Reading Average, 2007	267.1	261.0	14
Reading, 2007 (% at or above "proficient")	37.1%	29.2%	6
Writing Average, 2007	172.1	154.3	2
Writing, 2007 (% at or above "proficient")	52.6%	30.6%	2

ACT	CT	U.S. Avg.	State Rank
Percentage of Graduates Tested	19%	43%	38
Math Average, 2008	23.3	21.0	3
Reading Average, 2008	23.6	21.4	4
English Average, 2008	23.2	20.6	2

SAT	CT	U.S. Avg.	State Rank
Percentage of Graduates Tested	84%	48%	4
Math Average, 2008	513	515	33
Critical Reading Average, 2008	509	502	34
Writing Average, 2008	513	494	25

AP	CT	U.S. Avg.	State Rank
Math Scores, 2008 (% with a score of 3 or higher)	79.5%	65.2%	1
Math Exams, 2008 (Exams as % of all H.S. grads)	9.1%	8.7%	17
English Scores, 2008 (% with a score of 3 or higher)	79.5%	59.2%	2
English Exams, 2008 (Exams as % of all H.S. grads)	17.2%	18.9%	21

SUMMARY STATE EDUCATION METRICS

Selected Indicators	CT	U.S. Avg.	State Rank
High School Graduation Rate, 2005–06	80.9%	73.4%	13
Student/Teacher Ratio, 2006–07	14.7	15.5	25*
Low-income Students, 2006–07 (% of all students)	28.1%	41.6%	–
Expenditure per Student ($), 2005–06	$13,072	$9,154	4

Note: NAEP = National Assessment of Educational Progress, AP = Advanced Placement
N/A = Data not available. * Lowest value receives highest ranking.

TABLE SOURCE NOTES:

NAEP Assessments, grade 8: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (NCES), National Assessment of Educational Progress (NAEP), 2005; **ACT Exam:** ACT, Inc., 2008; **SAT Reasoning Test:** The College Board, 2008.

Advanced Placement (AP): Battelle analysis of data from the College Board, 2008; AP test takers as a share of high school graduates includes graduate data from U.S. Department of Education, NCES for both public (Common Core of Data) and private high schools (Private School Survey).

Science Teacher Indicators: Council of Chief State School Officers (CCSSO) analysis of State Departments of Education data on public schools, 2007; U.S. Department of Education, NCES Schools and Staffing Survey, 2003–04 as reported by CCSSO, 2007.

Summary State Education Metrics: U.S. Department of Education, National Center for Education Statistics (NCES), Common Core of Data (CCD) on public elementary and secondary education.

Note: High school graduation rates are averaged freshman graduation rates—the rate is the number of graduates divided by the estimated count of freshmen 4 years earlier. U.S. figure for share of students eligible for free or reduced-price school lunch ("low-income" students) is available for 2005–06 only (state data are for 2006–07).