



CALIFORNIA

Sciences & Life Sciences Achievement

STUDENT ACHIEVEMENT

NAEP Grade 8	CA	U.S. Avg.	State Rank
Science Average, 2005	136.1	147.1	43
Science, 2005 (% at or above "proficient")	18.1%	27.3%	42
Life Sciences Average, 2005	136.3	148.2	43

ACT	CA	U.S. Avg.	State Rank
Science Average, 2008	21.3	20.8	24
Biology, 2008 (% of students ready for college level)	32%	28%	20

AP	CA	U.S. Avg.	State Rank
Science Scores, 2008 (% with a score of 3 or higher)	55.5%	55.4%	26
Science Exams, 2008 (Exams as % of all H.S. grads)	13.9%	10.5%	6
Biology Scores, 2008 (% with a score of 3 or higher)	50.9%	49.8%	21
Biology Exams, 2008 (Exams as % of all H.S. grads)	6.5%	4.6%	5

SCIENCE TEACHER QUALITY and PROFESSIONAL DEVELOPMENT

	CA	U.S. Avg.	State Rank
Science Teachers with Major in Assigned Field, 2003–04 (% of all H.S. grads)	84%	77%	8
Science Teachers Certified, 2006 (% of all H.S. grads)	60%	N/A%	20
Biology Teachers Certified, 2006 (% of all H.S. grads)	84%	88%	24

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

Key Organization(s) Promoting Bioscience Education

The **California Biotechnology Foundation** is a collaborative public-education effort created by BIOCOM, BayBio, the California Healthcare Institute, and PhRMA.

Two of the state's BIO affiliates also have closely affiliated educational foundations: **BIOCOM Institute** and the **BayBio Institute**. Both are active in K-12 education, and both maintain

CA STATE SCIENCE STANDARDS & REQUIREMENTS

STANDARDS PROFILE

- Most recent update of K-12 Science Standards: **prior to 2005**
- Research scientists provided input in development of standards
- Science standards specifically mention applied laboratory or other tools for biotechnology or bioscience. The standards require that students "know how biotechnology is used to produce novel biomedical and agricultural products."

California Science Standards, Alignment of Academic Content Standards to Environmental Principles and Concepts, High School Biology/Life Science, 2006

BIOSCIENCE-RELATED GRADUATION REQUIREMENTS:

One unit of biology is required

52% of 6th through 9th graders and 40% of 10th through 12th graders met the "proficient" level under the No Child Left Behind (NCLB) Adequate Yearly Progress test



comprehensive career-oriented Web sites. BayBio conducted its first survey of science, technology, engineering, and mathematics (STEM) partnerships as early as 1991.

Bay Area Biotechnology Education Consortium (BABEC) is a nationally known regional network of five K-12 partnership programs (see below).

Active **Science Alliance** organizations in both San Diego and the Bay Area promote educational improvement and opportunity.

Examples of Bioscience Education Activities

In 2008, with support from the Bechtel Foundation, the **Center for Research, Evaluation, and Assessment** at the Lawrence Hall of Science in Berkeley surveyed formal (service to teachers and students in school), semiformal (after-school, summertime, and community programs), and informal (public-oriented) science education programs at 25 “Science Rich Educational Institutions” (SREIs) in the Bay Area, including California State University, East Bay; San Jose State University; Stanford University; University of California, Berkeley; University of California, San Francisco; and a long list of science museums, zoos, and aquariums. The study concluded that the subject SREIs have made science education a high priority and that these services are valued by teachers and school districts, but that their reach is limited, and many students in the Bay Area are still not reached. The study also found that the subject SREIs are strongly interested in scaling up their programs but require additional resources to do so. BayBio Institute and the Bechtel, Moore, and Noyce Foundations are meeting to coordinate further investment in the best programs. The Bechtel and Gates Foundations are also joining with the California

Council on Science and Technology to begin a statewide study of greater scope.

Teacher Preparation and Professional Development

The California Department of Education maintains an internal **Math & Science Partnership grant program**, aimed at teacher development and funded at \$22 million in the FY 2008–2009 budget.

The **California State University**, the state’s largest producer of math and science teachers, committed in 2004 to double its production of teachers in STEM disciplines from a baseline of 750 in 2003 to 1,500 by 2010. The six elements of the state-supported program are as follows:

- New credential pathways
- Financial support and incentives
- Recruitment to expand and diversify the pool
- Internet-supported delivery of instruction and resources
- Partnerships with California-based federal labs, businesses, and industry
- Collaboration between campuses and community colleges.

The University of California System also sponsors a centrally managed **California Science Project**, a professional development network for PK-16 teachers with sites across the state.

The Life Sciences Summer Institute (LSSI), a joint program of the San Diego Workforce Partnership, BIOCOM, BIOCOM Institute, and the Southern California Biotechnology Center (SCBC) at Miramar College has trained 67 teachers with the potential to reach 28,000 students. The 12-day paid program includes an introduction to the industry, laboratory curriculum training, and half-day industry externship experiences. The **LSSI Teacher**



Externship Program is hosted at Biogen Idec in its Community Laboratory facility and utilizes the Amgen-Bruce Wallace Biotechnology Laboratory Program curriculum. Participants receive free supplies, loaner equipment, and ongoing staff support for curriculum implementation throughout the school year.

Additionally, BIOCUM and the BIOCUM Institute credit multiple companies and institutions with partnering to provide professional development opportunities for K-12 bioscience teachers and students. Among these are San Diego Workforce Partnership, Biogen Idec, Life Technologies, Amgen, Goodwin Procter, Alexandria Real Estate, Althea Technologies, Arena Pharmaceuticals, Celgene, Conatus Pharmaceuticals, Merck Research Laboratories, Pfizer Foundation, San Diego Foundation, Agouron Institute, Accumetrics, Alexion Antibody Technologies, Amgen Foundation, Anadys Pharmaceuticals, Assure Controls, Bioserv Corporation, Burnham Institute for Medical Research, Conservation and Research for Endangered Species (CRES), The Dow Chemical Company, eStudySite, Genentech, Genomatica, Genoptix, Gen-Probe, Isis Pharmaceuticals, Karl Strauss Brewing Company, MO BIO Laboratories, Nanogen, Pfizer, Salk Institute for Biological Studies, San Diego Science Alliance, San Diego State University Labs, Senomyx, SGX Pharmaceuticals, SCBC Miramar, Sunrise Science Products, and The Scripps Research Institute.

Stanford University has made Improving Teacher Education one of five university-wide interdisciplinary challenges. Among the central programs are the **Stanford Teacher Education Program** and the **School Redesign Network**. Additionally, the Stanford Office of Science Outreach coordinates a wide range of other

programs for K-12 STEM teachers, including a **Summer Research Program for Teachers**, which offers teachers 4 days a week in a Stanford Lab.

The five partnerships sponsored by **Bay Area Biotechnology Education Consortium** have aspects of both professional development for teachers and experiential education for students. The five are East Bay Biotechnology Education Program; Gene Connection (San Mateo County); Program in Biotechnology Education (Marin County); Santa Clara County Biotechnology Education Partnership (SCCBEP) (Santa Clara County); and San Francisco Biotechnology Alliance for Science Education (SF-Base) (San Francisco Unified School District).

The **Scripps Research Institute's Science Partnership Scholars Program** is open to all middle- and high-school science teachers in San Diego County. Under the supervision of senior faculty, a cadre of doctoral candidates has developed a curriculum on state-of-the-art research topics and techniques including hands-on experiments that can be used in the classroom.

Experiential Learning and Outreach

The **LSSI Student Internship Program and High School Student Research Program** begins with a 1-week Biotech "Boot Camp" held at the SCBC at Miramar College providing attendees with hands-on training in basic laboratory skills and soft skill development. Following the boot camp training, students begin a 7- to 10-week paid internship within the life sciences industry or at one of San Diego's scientific research institutes. To date, the program has placed 173 students into such internships.

BayBio Institute manages the southwest regional (multistate) section of the **Sanofi-Aventis BioGENEius Challenge**, a competition for high





school students that recognizes outstanding research in biotech.

BIOCOM Institute's Science Education Speakers Bureau matches biotech professionals from business, research, and higher education with opportunities to teach specifically identified classroom units.

The Salk Institute for Biological Studies in La Jolla offers a **High School Student and Teacher Summer Enrichment Program**, the **Salk Mobile Science Laboratory**, and a **High School Science Day**.

The **Scripps Research Institute's High School Student Research Education Program** exposes students to contemporary issues in biomedical research and provides hands-on laboratory experience and mentorship.

The Stanford Office of Science Outreach sponsors the following:

- **Summer Research Internship Program for High School Students**, a 7-week program for students nominated by their local districts.
- **Stanford Medical Youth Science Program**, 5-week intensive training for low-income and underrepresented high school students from north/central California.
- **Stanford Institutes of Medicine Summer Research Program**, an 8-week program for high school juniors and seniors interested in hands-on research.
- **Med School 101**, an introductory session for high school students.

Multiple campuses of the University of California System are involved in experiential

learning and outreach programming either through cooperative extension programs or through its main academic divisions. Among them are as follows:

- **UCSF Science and Health Education Partnership (SEP)** founded 1987 and now housed in the Department of Biochemistry and Biophysics
- **UC Irvine Programs for Outreach Research and Training (PORT)**
- **UC Riverside Academy of Learning through Partnerships for Higher Achievement (ALPHA) Center**
- **UC Davis**, which sponsors the state's **Mathematics, Engineering, and Science Achievement (MESA) program**.

Bioscience-focused Schools and Programs

Through its charter school program and other initiatives to improve local school districts, California has founded numerous life science academies in both academic and career and technical education tracks. Some sample programs are as follows:

- **High Tech High in San Diego**, which was founded as a charter school and has evolved into a school-development organization
- **Life Academy High School of Health and Bioscience in Oakland**, a rigorous pre-college prep program for largely low-income students.



Basic Skills Achievement and Other Summary Metrics

STUDENT ACHIEVEMENT

NAEP Grade 8	CA	U.S. Avg.	State Rank
Math Average, 2007	270.4	280.2	45
Math, 2007 (% at or above "proficient")	23.9%	31.0%	41
Reading Average, 2007	251.3	261.0	48
Reading, 2007 (% at or above "proficient")	21.5%	29.2%	45
Writing Average, 2007	147.9	154.3	38
Writing, 2007 (% at or above "proficient")	24.6%	30.6%	36

ACT	CA	U.S. Avg.	State Rank
Percentage of Graduates Tested	17%	43%	40
Math Average, 2008	22.8	21.0	7
Reading Average, 2008	22.4	21.4	19
English Average, 2008	21.8	20.6	12

SAT	CA	U.S. Avg.	State Rank
Percentage of Graduates Tested	49%	48%	23
Math Average, 2008	515	515	32
Critical Reading Average, 2008	499	502	35
Writing Average, 2008	498	494	33

AP	CA	U.S. Avg.	State Rank
Math Scores, 2008 (% with a score of 3 or higher)	65.7%	65.2%	23
Math Exams, 2008 (Exams as % of all H.S. grads)	11.4%	8.7%	4
English Scores, 2008 (% with a score of 3 or higher)	58.3%	59.2%	35
English Exams, 2008 (Exams as % of all H.S. grads)	23.9%	18.9%	8

SUMMARY STATE EDUCATION METRICS

Selected Indicators	CA	U.S. Avg.	State Rank
High School Graduation Rate, 2005–06	69.2%	73.4%	40
Student/Teacher Ratio, 2006–07	20.9	15.5	49*
Low-income Students, 2006–07 (% of all students)	50.2%	41.6%	–
Expenditure per Student (\$), 2005–06	\$8,301	\$9,154	33

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).

