

CALIFORNIA CRUNCH

Chemistry departments at California's **PUBLIC UNIVERSITIES** face decreasing budgets but increasing demand

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THREE YEARS AFTER the Great Recession of 2008 officially ended, state coffers are still far from recovered and public colleges and universities are struggling to maintain their programs. In California, the state's three tiers of higher education have grappled with billions of dollars in cuts as they educate some 3 million students, more than any other state in the country.

For students, the cuts mean higher tuition alongside reduced access to classes, even as they see education as essential to avoiding or escaping unemployment. For faculty, the cuts mean trying to minimize the effects of smaller budgets on students and on educational quality.

"At the time we have the greatest demand, we have the fewest resources," says Martin Wallace, a chemistry professor at Lake Tahoe Community College. Many schools have had to curtail enrollment, a bitter pill to swallow for instructors in a system created with the explicit commitment to have a spot available for every California high school graduate who wants one. According to California's 1960 Master Plan for Higher Education, the two-year California community colleges would take all comers, but the top third of graduating high school seniors and all community college graduates would be able to enter a California state university (CSU). The plan promises the top eighth of high school graduates spots at one of the University of California (UC) campuses.

Even as legislators slashed the higher education budget, however, chemistry faculty report that their classes have largely been spared decimating cuts because chemistry departments play a critical service role in educating students from a variety of disciplines. "There is a world of hurt out there, and I think we have been treated more gently than other departments," says Scott D. Rychnovsky, chair of the chemistry department at UC Irvine. But faculty have

also been unable to accommodate student demand for science courses, and they are concerned about aging instruments and infrastructure. Departments in the UC system report the mildest effects, because they have more diverse funding sources and have al-

ways had selective admissions. The budget crunch is felt much more keenly by the CSU system and the community colleges.

The system now in the tightest bind is arguably the community colleges, which enrolled 2.4 million students in 2011–12, down from a peak of 2.9 million students in 2008–09. Whereas the CSU and UC systems can set their own student fees, community college fees are set by the state legislature, so the colleges cannot independently raise fees to compensate for declining state support.

Lake Tahoe Community College was the only community college science department contacted by C&EN that increased its enrollment in general chemistry courses over the past few years. But the department now faces the cancellation of a number of sections in the upcoming academic year because qualified lecturers won't accept the low salary the college can afford to pay, Wallace says.

Other community colleges have managed at best to maintain chemistry enrollment. Chemistry classes at Saddleback College have continued relatively unscathed over the past few years, reports department chair Scott Fier, although the department isn't meeting demand. "We could increase by at least 50% the number of sections that we offer," he says.

At Bakersfield College, cutbacks are just beginning, reports Kenward Vaughan, a chemistry professor and chair of physical sciences at the school. Next year he is shelving a class for nursing and radiologic technology students that requires two labs per week in favor of a class that requires only one lab per week to reduce teaching loads.

Elsewhere, cuts started earlier and are continuing. Located in Redding, Shasta College has reduced its enrollment cap by about 10% in the past few years, says Cliff Gottlieb, a chemistry professor and faculty coordinator for physical sciences. Even though chemistry classes have been fairly well protected, "we've cut sections even in high-demand courses," Gottlieb says.

Community college representatives also report that their lab supply budgets have remained flat, even as costs of supplies have risen. So far, schools have generally avoided changing lab curricula, although Las Positas College is now pairing up students to do some experiments that used to be done individually, says Neal Ely, dean of the school's division of math, science, engineering, and public safety.

Lab equipment is a bigger concern. School representatives say they're getting by, but some lab equipment is almost antique. The computer that runs the gas chromatograph-mass spectrometer at Shasta uses 5.25-inch floppy disks. "Overall we're doing okay, but at any given moment we could lose one of our instruments" and have no means to repair or replace it, Gottlieb says.

In contrast to enrollment stasis or cuts seen at the community college level, CSU chemistry departments have tried to expand to meet increasing demand for their courses, but they can go only so far. "The system was designed both physically and philosophically to have small class sizes,"



PAT LEONARD-HEFFNER/LAKE TAHOE COMMUNITY COLLEGE

CUTBACK VICTIMS

Lake Tahoe Community College students will have fewer chemistry class options in the coming year.

says Christina A. Bailey, chair of the chemistry and biochemistry department at California Polytechnic State University, San Luis Obispo. Only rarely do lecture halls on CSU campuses seat more than 130 students, and the largest classrooms are also now in constant use.

Spots in teaching laboratories are also limited by capacity. If Fresno State University had the space, demand for first-semester organic chemistry lab is such that it could double the number of sections it offers, says chemistry department chair Saeed Attar.

Space affects research labs as well. In addition to master's students, departments try to accommodate undergraduate chemistry majors who want to do research to improve their chances for a job or a graduate school spot. But just as CSU departments have small teaching facilities, they also have small research laboratories. Between space and time constraints, faculty at CSU San Bernardino can take only two or three research students on average, says Brett Stanley, chair of the chemistry and biochemistry department. With 284 undergraduate majors, 18 master's students, and 11 permanent faculty, that leaves a lot of students that they can't accommodate.

And money is not available to add tenure-track faculty. CSU East Bay, San Bernardino, Sacramento, and Long Beach, plus Cal Poly San Luis Obispo, have at least been able to maintain their tenured and tenure-track chemistry ranks. At other schools, such as Fresno and Humboldt State University, the ranks of permanent faculty have thinned significantly. Permanent chemistry faculty at Humboldt have dropped from about 15 to six, reports department chair Monty M. Mola.

In all cases, schools have expanded their adjunct ranks to address course needs. But increasing reliance on adjunct lecturers may harm educational qual-

ity, department chairs worry. "There is a critical fraction of instruction that must be handled by tenured or tenure-track faculty, because otherwise there is a disconnect between long-range planning and curriculum development and what is being taught in classrooms," says CSU Long Beach chemistry department chair Krzysztof Slowinski.

LIKE THEIR COMMUNITY college counterparts, CSU chemistry chairs generally report managing with flat supply budgets but being concerned about equipment in the long term when no funds are budgeted to maintain, repair, or replace instruments. Schools have also largely lost any staff support they had for instrumentation. Faculty do what they can to fill the gap, Slowinski says, but their time is limited.

Aside from trying to keep lab instru-

ments going while teaching, grading, and advising larger numbers of students, CSU faculty also face pressure to publish and secure funding for their research in order to be promoted, notes Ann McPartland, chair of the chemistry and biochemistry department at CSU East Bay, in Hayward. Schools did have teaching release time available to allow faculty some research-focused periods, but several campuses—McPartland's included—have cut back those programs or eliminated them entirely. Between time constraints and tight federal research budgets, McPartland is worried that faculty will find it difficult to make enough research progress to obtain or maintain funding.

At UC chemistry departments, "we occasionally struggle but always adapt," says UC Berkeley chemistry department chair

Daniel M. Neumark. He points to the eight assistant professors in his department as a sign that, even in tough budget times, his school has been willing and able to invest in its chemistry faculty.

Other UC chemistry departments have not fared as well, but they've generally been able to maintain their permanent faculty. Although schools may no longer guarantee replacements for faculty who retire or are denied tenure, the large numbers of students taking chemistry courses mean chemistry departments often rank highly when universities prioritize where to fill positions, department chairs report.

UC chemistry departments are also dealing with increased demand for their courses. "The numbers are eye-popping," says Neil E. Schore, vice chair of chemistry at UC Davis. In the 2011–12 academic year, the department taught general chemistry to nearly 10,000 students. Thanks to a building constructed a decade ago, the department has been able to accommodate more lab sections,

CALIFORNIA COLLEGES & UNIVERSITIES

Schools make do with decreasing state support while students contend with escalating fees

CALIFORNIA COMMUNITY COLLEGES	2001–02 ^a	2006–07 ^a	2011–12
Campuses	108	109	112
Faculty headcount	55,914	59,820	56,495
Tenured/tenure-track	17,879	18,196	17,620
Lecturers	38,035	41,624	38,875
Undergraduate student headcount	2,768,852	2,596,419	2,440,549 ^b
Undergrad student annual fees	\$422	\$765	\$1,080
Total annual budget	\$5.94 billion	\$6.78 billion	\$5.93 billion
State funding	\$3.33 billion	\$4.38 billion	\$3.60 billion
CALIFORNIA STATE UNIVERSITY			
Campuses	22	23	23
Faculty headcount	22,226	24,066	20,928 ^c
Tenured/tenure-track	10,325	10,682	10,098 ^c
Lecturers	11,901	13,384	10,830 ^c
Undergraduate student headcount	307,450	344,445	367,139
Undergrad student annual fees	\$1,824	\$2,793	\$5,472
Graduate student headcount	45,666	51,579	46,569
Grad student annual fees	\$1,924	\$3,438	\$6,738
Total annual budget ^d	\$4.41 billion	\$4.69 billion	\$3.97 billion
State funding	\$3.33 billion	\$3.11 billion	\$2.10 billion
UNIVERSITY OF CALIFORNIA			
Campuses	9	10	10
Faculty headcount	14,735	16,765	17,898
Tenured/tenure-track	7,758	8,771	9,029
Lecturers/other teaching faculty	6,977	7,994	8,869
Undergraduate student headcount	148,024	163,302	181,508
Undergrad student annual fees	\$4,380	\$6,807	\$12,192
Graduate student headcount	39,254	45,884	49,760
Grad student annual fees	\$4,610	\$7,645	\$12,192
Total annual budget ^{d,e}	\$8.64 billion	\$8.99 billion	\$10.74 billion
State funding	\$4.37 billion	\$3.75 billion	\$2.44 billion

^a Dollar amounts adjusted for inflation to 2012 values. ^b Estimated at 93.5% of 2010–11 enrollment. ^c Fall 2010 headcount. ^d Does not include external grant funding. ^e Does not include teaching hospitals or Department of Energy laboratories.

SOURCES: California Community Colleges, California State University, and University of California systems; California Postsecondary Education Commission

“but we have just about hit the wall there,” Schore says. Like their CSU counterparts, UC chemistry departments generally use lecturers when additional faculty are needed to teach.

Some schools have had to make surgical cuts to balance teaching loads and supply budgets. UC Irvine, for example, no longer offers an honors organic chemistry class. And UC San Diego has reduced the frequency that it offers its most expensive lab class, an upper-level inorganic lab, from two quarters per year to one.

Chemistry department chairs generally report having to fight for enough money to maintain teaching assistant positions to preserve class coverage and help support graduate students. At UC Santa Cruz, for example, the chemistry department has dropped its teaching assistant to student ratio for discussion sections from 1:20 to 1:38. Department chair Ilan Benjamin isn't sure what will happen in the upcoming year, he says, because even the 1:38 ratio depended on temporary funds.

Many department cuts have involved eliminating staff positions, such as instru-

ment technicians and stockroom support. Some cuts have forced departments to operate more efficiently. But “after several years, the stuff you are cutting really hurts, and we're definitely into that range,” Irvine's Rychnovsky says.

THE BIGGEST CONCERN at the UC campuses is infrastructure and instrumentation. “We have old buildings, which need to be either replaced or extensively renovated,” Berkeley's Neumark says. The school obtained a grant from Dow Chemical to renovate its teaching labs, but research labs are an ongoing concern.

Others are worried about maintaining teaching or departmental research instrumentation and repairing or replacing anything that breaks. UC San Diego has upgraded its department instrumentation substantially in the past decade, “but we have failed to secure hard money lines to pay for staff and maintenance,” says Seth M. Cohen, chair of the chemistry and biochemistry department. “Charging individual researchers for these core services is not an adequate or stable source

of support for these essential facilities.”

Overall, faculty at all of the public colleges and universities in California believe they have done fairly well at weathering the recession and the years since. “I think we have managed to maintain the essence of who we are and the quality of the education we provide,” says Linda M. Roberts, chair of the chemistry department at CSU Sacramento. But “I think it's required tremendous effort from faculty to make that happen,” she adds, “the faculty are very tired. I don't know that we can do it indefinitely.”

Uncertainty looms over the coming years. The state budget passed by the legislature on June 16 depends in part on a tax proposition on the November ballot. If the proposition doesn't pass, California public college and university budgets will face new cuts totaling \$1.1 billion for 2012–13, taking the academic systems back to the funding levels of the late 1990s but with far more students. If the cuts happen, how schools will cope is unclear, but one thing is certain: Another round of cuts will break the promise of higher education for all Californians. ■



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