

# Realizing a Technological Vision in Alameda County, California

by Nancy Maddox, MPH, writer

**A**lameda County, CA, like many communities in The Golden State, has been inhabited by an evolving mix of peoples through the centuries. First came the Ohlone Native Americans, who hunted on the lands surrounding modern-day San Francisco Bay. They were followed, in turn, by Spanish colonists, Mexican ranchers and a motley mix of American and Asian settlers. In 1853, Alameda County was officially established, carved from portions of adjacent Contra Costa and Santa Clara Counties.

From the beginning, the county has had a symbiotic relationship with its neighbor on the other side of San Francisco Bay. In the late 18th and early 19th centuries, Alameda County was a ferry and trolley car suburb of “Fog City.” Since 1933, after the San Francisco–Oakland Bay Bridge linked the two jurisdictions, commuters can travel back and forth entirely by car or bus (or by underwater tube since 1967). Today, said Mark Pandori, PhD, HCLD(ABB), director of the Alameda County Public Health Laboratory, the county has its own, multi-faceted identity, although it remains linked to San Francisco.

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Sky high housing prices, for example, are driving many San Franciscans into East Bay, as the urban area immediately east of San Francisco Bay is known. Rents in Oakland—Alameda County’s county seat and the largest East Bay city—are rising faster than anywhere else in the country. Yet even with the rising cost of living, Alameda County’s population is “perhaps more diverse than any other Bay Area county,” said Pandori, with large African-American, Asian, Latino and LGBTQ communities. The presence of the University of California (UC) at Berkeley, the prestigious flagship campus of the UC system, adds to the mix.

Pandori said this diverse and peripatetic population of about 1.5 million makes TB, HIV and sexually transmitted disease (STD) testing priorities for the public health laboratory. “But what’s interesting,” he said, “is that beyond the heavily urbanized zone, we have a huge rural zone east of the Oakland Hills. There’s quite a lot of rabies out there—recently, all in bats—and some Lyme-containing ticks in the southern end of the county.” The laboratory tests for the rabies and speciates the ticks. The rural zone—easily over half of Alameda County’s 821-square-mile area—is also home to a budding wine industry and, importantly, a number of aquifers, wells, lakes and streams. Testing these local waters, plus swimming pool water, supplies a major portion of the laboratory’s business.

When Pandori assumed the directorship of the county’s public health laboratory, he came with a “technological vision” that skewed toward advanced molecular testing. Almost three years later, much of that vision has been realized, with a heavy laboratory emphasis on PCR testing and whole genome sequencing (WGS).

## Facility

The Alameda County Public Health Laboratory occupies one of the most distinctive laboratory facilities in the country—a three-story concrete, steel and glass edifice outfitted with an exoskeleton of latticework festooned with “gigantic shock absorbers,” which encircle the building. The unusual structure is the most visible sign of the subterranean Hayward Fault line that lies a mere 500 yards from the laboratory.



Alameda County Public Health Laboratory

The building was erected in 2014 in a “pretty wooded glade” at the base of the Oakland Hills, just “a stone’s throw away” from the acclaimed Oakland Zoo and even nearer to Interstate 580, a major freeway traversing northern California. The county coroner takes up the first floor; the public health laboratory, the second floor; and the county crime lab, the third floor. Because of the crime lab, said Pandori, the security is “absolutely through the roof,” requiring entry through four separate cardkey-locked doors just to reach the public health laboratory. Once inside, however, visitors find the 13,000-square-foot facility has all the bells and whistles a modern public health laboratory demands, including one BSL-3 suite (currently certified as 2+). The laboratory, said Pandori, is “gorgeous.”

## Director

Pandori was born in Philadelphia, but raised mostly in San Jose, CA. He earned a BS in genetics from UC–Berkeley, and then decamped to Boston University, where he developed HIV assays for a year. After that stint, Pandori returned to the West Coast, earning a PhD in biomedical sciences from UC–San Diego under the tutelage of John Guatelli, MD, and Douglas Richman, MD, two stars of the HIV research community. A post-doctoral fellowship with Harvard Medical School took him back to the East Coast, where he conducted viral engineering for gene therapy at the Beth Israel Deaconess Medical Center, a teaching hospital for the medical school. Pandori then worked as a post-doc and instructor of medicine at Harvard Medical School for six years, before another cross-country trip to California, where, in 2005, he became chief microbiologist for the San Francisco Department of Public Health, working under the direction of Sally Liska, DrPH. In 2009, he gained a joint position as associate clinical professor of laboratory medicine at UC–San Francisco. And in 2010, after Liska’s retirement, he assumed the position of laboratory director. The twin lures of a brand new laboratory and the opportunity to work with an esteemed colleague, Erica Pan, MD, drew him to his current post in the Alameda County Department of Public Health Laboratory in mid-2014.

## Staff

In addition to Pandori, the laboratory employs 10 people, including five full time microbiologists (one at the PhD level), a laboratory supervisor (who is also a DVM), two laboratory technicians and two administrators. Altogether, seven of the staff members are state-certified public health microbiologists. There is currently one open microbiology position.

## Revenue

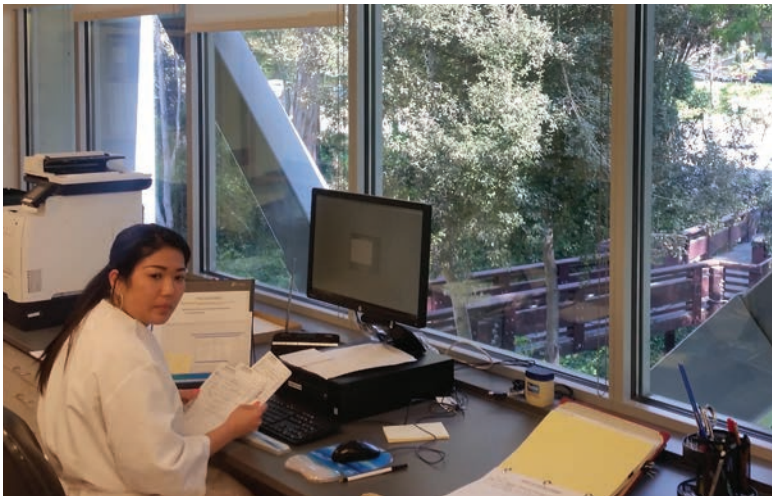
The laboratory’s revenue comes from a mix of county general funds, grants and billed laboratory tests.

## Testing

Overall, the laboratory's highest-volume service is latent TB testing, followed by oral fluid HIV testing and testing of recreational and drinking water. Also on the service menu is active TB testing, HIV RNA testing, STD testing (by PCR and syphilis serology) and testing for influenza and other respiratory agents (by PCR). Thanks to the presence of a highly experienced mycologist on staff, Steve Killian, the lab is a major center for mycology in Alameda County, often dealing with identification of nosocomial infections in immunosuppressed individuals.

## Success Stories

- The laboratory is one of two facilities examining nucleic acid amplification technologies for their ability to detect chlamydia and gonorrhea in rectal and throat specimens, as part of a study led by the Duke Clinical Research Institute and funded by the National Institutes of Health.



Microbiologist Thanh Tran reviews testing data in the Mycobacteriology Lab

- In September 2016, the laboratory completed a large validation study on the use of next-generation WGS for bacteriologic identification. Now, instead of using traditional biochemical methods, it performs WGS on every sample submitted for bacteriologic testing. Working in collaboration with David Hess, PhD, of Santa Clara University, the laboratory developed a software tool that rapidly identifies and characterizes bacterial species based on whole genomic information. Said Pandori, "The benefits of that are logistical



Alameda County Laboratory group



Laboratory assistant Rene Gonzalez in the Mycobacteriology lab

## Challenge

Pandori's major challenge of the moment is finding qualified (i.e., state-certified) and motivated employees to fill vacancies, such as a currently open microbiology position.

## Goals

Pandori has three major goals for the laboratory.

- WGS: "The vision now is to see how far we can take our WGS efforts. We want to follow in Wadsworth's footsteps and see if we can use this technology for TB drug susceptibility testing. That would give us a detailed analysis of all TB organisms, including all of the drug-susceptibility data at once at the time of culture and simultaneous with molecular epidemiology data."
- Establishing electronic ordering and results reporting via direct interfaces with customers, including a user-friendly web interface where customers can log in to review the status of a specimen.
- *Neisseria*: "It seems there might be genetic interplay amongst the organisms in that genus. For example, *N. gonorrhoeae* seems to have gained some drug resistance by mixing with other *Neisseria* in the throat. We want to study the emergence of this potentially new public health threat."
- Funding: "I'd like to expand our billing capabilities so we can bill additional insurers."

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and informational. We have fewer biochemists on staff and less media to maintain and do quality assurance on. We also have a massive amount of data on organisms in our county. What does that mean? When we identify an organism by WGS, we rapidly, automatically obtain information on subtype, virulence factors (e.g., the presence or absence of Shiga toxin markers), drug resistance markers and the relatedness of organisms." One interesting finding, so far, was the identification of a novel *Neisseria meningitidis* that presented as a sexually transmitted infection on a patient's penis. As it turned out, the *N. meningitidis* contained gonococcal DNA.

- Last year, the laboratory served as a clinical trial site for a novel *Treponema pallidum* serology assay—the automated rapid plasma reagin test, which will soon be available commercially.
- Last December, the laboratory successfully used WGS to characterize the microbe at the center of a *Streptococcus pneumoniae* outbreak in Alameda County. Laboratory findings informed the epidemiological investigation that quickly resolved the outbreak.