

## At bioterror labs, a high-risk habitat

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SAN ANTONIO -- Just to get to work, scientist Ricardo Carrion Jr. must venture through three security checkpoints, don a head-to-toe vinyl suit as bright as the spring sky, and get through two submarine-style doors.

Only then does he lumber into the sterile room that houses the world's deadliest microscopic killers, behind 12-inch-thick slabs of concrete and bulletproof glass. There, inside a Biosafety Level 4 lab, the same kind of research center destined to rise in Boston's South End, his gloved hands work gingerly with viruses that cause Ebola, Lassa fever, and SARS.

"Unless I accidentally jab myself in the finger and infect myself with something, I feel perfectly safe," said Carrion, who specializes in virology at the Southwest Foundation for Biomedical Research in San Antonio, one of just three institutes in the nation with operational, full-scale Level 4 labs.

Safety concerns are at the heart of opposition to the high-security lab scheduled to open at Boston University Medical Center in October 2007. Foes of the facility say it will imperil a congested urban corridor that rings the university's medical school campus. They imagine worst-case scenarios in which, through accident or terrorism, an agent such as pneumonic plague would be unleashed into the air, causing an epidemic of respiratory failure, shock, and sudden death.

But decades of experience with Level 4 labs shows that the greatest risk resides with the researchers who handle needles that can jab and animals that can bite. Dangerous viruses and bacteria have never escaped from one of the high-security labs into surrounding communities, federal health agencies say. Scientists, however, have come perilously close to being exposed.

At the US Army Medical Research Institute of Infectious Diseases in Maryland, for example, researchers recall 15 episodes in which scientists were potentially exposed to infection, most often because of a wayward needle or a snapping animal being used in a study. None of those incidents, though, resulted in illness.

Similarly, in the three years since the Level 4 lab at the Southwest Foundation went active, the only times safety concerns arose were when a researcher's glove tore and when another's protective suit snagged on a protruding knob. Neither suffered any harm.

But the very real risk that a slip of the hand or a suddenly restless animal could expose a scientist to an incurable disease has prompted extraordinary precautions in the labs.

"I tell people that if something is going on at home or you're not feeling top-notch, don't go in -- it's not worth the risk," said Randal Schoepp, a microbiologist at the Army institute. "When you're working with these types of agents, you can't afford a mental lapse."

Critics of President Bush's campaign to build more Level 4 labs, a cornerstone of the administration's efforts to guard against bioterrorism, argue that sweeping assurances about their safety are based on the experience of just a handful of research institutes.

In a few years, more than 600 scientists could be working with lethal microbes at the BU lab, and hundreds more are expected to do the same at the University of Texas Medical Branch in Galveston, the other new Level 4 lab selected last month by the National Institutes of Health.

"We're really going onto uncharted ground, in terms of the number and size of these labs," said Edward Hammond, director of Sunshine Project US, an activist organization concerned about the proliferation of highly

sophisticated research labs. "Just looking at it logically, you have to take a broader sample to get a reasonable appraisal of the risk."

At BU, infectious disease specialists expect to concentrate on at least three agents: anthrax; botulinum, a bacterium that results in a potentially lethal paralytic illness known as botulism; and tularensis, a bacterium spread by rodents, rabbits, and hares. To make sure they remain inside the research center, BU plans security measures that will exceed those in San Antonio, with outside auditors enlisted to monitor construction of the lab.

Still, that's not enough for a coalition of South End and Roxbury residents, who have told the university they plan to sue to stop the lab.

In San Antonio, by contrast, there was scarcely a whisper of protest when the foundation announced plans to build a Level 4 lab. By the time it opened in 2000, it sat squarely amid the archetypal terrain of a Sun Belt city: rambling apartment complexes within a mile and a necklace of fast-food joints, hotels, and home-improvement stores within eyeshot.

It's the sort of urban stretch that invites folks who live nearby, like Margaret E. Stephens, to come out on a balmy fall night for an Italian dinner sandwiched between trips to Lowe's or Wal-Mart.

Like other residents, Stephens said she was familiar with the foundation's work and supported it, harboring no fears for the safety of herself or her family, who live not far away.

"They're not going to put themselves at risk," Stephens said. "So they're not going to put us at risk."

Jean L. Patterson presides over the Level 4 lab at the Southwest Foundation, a private institute on a sprawling campus near a stretch of interstate branded Loop 410 by the residents. The microbiologist left Harvard Medical School in 1996, in part, to do something she figured cautious Harvard administrators would never do: build a Level 4 research center devoted to the study of infectious disease.

"I was once asked what the scariest part of my job was, and I said it was driving the access roads to Loop 410," said Patterson, sitting in her office, where three glowing television monitors track activities inside the lab. "Nothing comes out alive from that lab, except the humans."

The lab is impenetrable without the right ID card and the right knowledge of certain codes. "Somebody couldn't kidnap me with just this and get in," Patterson said, holding aloft her ID badge.

And no one enters the hot zone without clambering into an astronaut-like moon suit. The suits are tethered to coiled hoses that supply air, pumped in to create positive pressure.

"The beauty of being under positive pressure," said Jack Kelley, the Southwest Foundation's director of Environment, Health and Safety, "is that it's like a hole in your tire. It leaks out, not in," so microbes can't easily enter through a hole.

Air is drawn out of the lab and into filtration systems, so that no microbes are directly released to the outside, passing instead through filters that trap even the most minute particles.

"It's the cleanest air in the city coming out of there," said James M. Drewry III, an engineer involved in the design and construction of the Southwest Foundation's lab.

Scientists in the lab usually work with potentially lethal agents inside biocontainment cabinets to provide another layer of safety.

On a typical day this month, Carrion used a needle inside the safety cabinet to draw up the virus that causes Lassa fever, a rodent-borne illness afflicting West Africa. He injected the virus into five guinea pigs who had previously been given a vaccine that researchers hope might stop the spread of the disease.

Researchers enter the lab in teams of at least two, with another scientist on the outside of the lab monitoring their activity, measures taken to assure safety. They rarely spend more than four hours inside the bulky moon suits, partly because the work is tiring, but also because there is no bathroom inside the lab.

Once scientists finish, they pass back through one of those submarine-style doors to an anteroom where they are misted with a disinfecting solution and then with water.

The resulting fluid is sent to a holding tank below the lab and, ultimately, to a second stainless steel tank that cooks the liquid to 250 degrees. "Nothing we know of lives at 250 degrees," Drewry said.

After emerging from that rinse and shucking the moon suit, scientists jump into a more conventional shower.

Of course, the microbes must get to the lab in the first place, and they arrive in minute amounts via a package delivery service, often in forms that could cause no harm. Anthrax, for example, is delivered to Level 4 labs in a state that does not allow spores to migrate. Instead, scientists must take the material that is delivered and perform experiments inside the lab to create spores for study.

The scientists responsible for overseeing BU's lab expect to learn from the experiences of researchers in San Antonio, as well as those at the Army lab and at the US Centers for Disease Control and Prevention, in Atlanta, the third institute with an operational Level 4 lab. The BU lab is expected to generate \$1.7 billion in grants over the next two decades. "So much of the design is about safety, not only for the building, but for the workers in the building," said Dr. Mark S. Klempner, associate provost for research at the BU School of Medicine.

While much of the planning for the BU lab exists in the realm of science, university administrators are acutely aware that they need to concentrate more on the world of politics. That is why they are planning to expand efforts, they said, to address the concerns of their neighbors, by conducting more meetings and also providing job training, so that people in the community can seek jobs in the highly sophisticated lab.

They hope to find more people like Carrion, the San Antonio researcher whose passion for working with the exotic and the dangerous led him to the Level 4 lab.

"Whenever you're working on something mysterious, it's cool to figure out how it came about and what the things were that caused it to emerge," Carrion said. "People care a lot about these things, especially after Sept. 11 and with terrorists running around."

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