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Abstract: Offers a look at the maximum-containment biosafety laboratory for microbe studies at the Southwest Foundation for Biomedical Research in San Antonio, California. Security measures to contain the spread of miscrobes; Why deadly viruses have emerged; Threat posed by dengue fever, Venezuelan equine encephalitis and arenavirus in Texas.

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KILLER BUGS

BAD NEWS FROM A SAN ANTONIO LAB THAT STUDIES THE MOST-LETHAL MICROBES IN THE WORLD: THE GERMS ARE WINNING.

BEFORE VISITING TEXAS' ONLY MAXIMUM-CONTAINment biosafety level 4 "hot lab"--one of four places in the nation where the most-lethal and most-incorrigible microbes are cultured and studied-I had a single question for the lab's chief keeper, Jean Patterson, the head of virology and immunology at the Southwest Foundation for Biomedical Research in San Antonio, where the lab is located. Sure, the lab was "down" and had been thoroughly decontaminated for a round of cleaning and repair. This was, in fact, the only reason I was being allowed anywhere near it. But how could I be certain that there wasn't a single errant arenavirus or herpes B bug in there just waiting to crawl up a nostril and kill me?

Patterson flashed a surprisingly beatific smile, considering her line of work, and replied, "Well, you can't."

That was either more than I wanted to know or less. Not that I really needed to worry about stray bugs. The most sophisticated microbe lab in Texas is also the most paranoid. Just to get near it, we had to pass through an endless series of doors of varying sizes and securities-bug-containment technology that made up the better part of the cost of the $12 million building. And though the lab itself is a modest 1,200 square feet, it is backed up by two other rooms of air- and water-filtration systems; huge drums of Lysol-yes, Lysol-concentrate, which is used to decontaminate everything, including the scientists before and after they enter the lab; and enough high-tech emergency bells and whistles to shame the folks at NORAD. When the nasty microbes are in residence, the atmosphere in the lab is pressure negative, meaning that the higher air pressure outside the room keeps the bugs from escaping; so if someone spills a beaker of hantavirus--a feisty little creature that causes fever, vomiting, and shortness of breath in one strain of the virus, and kidney infection and internal bleeding in another--the chances of it destroying the population of

Central Texas are greatly reduced. Before entering the lab, Patterson and her colleagues must don robin's egg-blue polyurethane vinyl jumpsuits with attached helmets that are wired for two-way communication-like the ones astronauts use.

"Constant contact is important in case someone, you know, has a heart attack or something in there," said Patterson. "We also have an alarm for that. We have an alarm for everything."

Visit any other sort of biomedical institution these days-say, a gene therapy lab at M. D. Anderson Cancer Center--and you'll leave with the unmistakable impression that man is winning the war against disease and infirmity. But visit a maximum-containment lab like this one and you'll draw a different conclusion. This lab wouldn't have been built at all if we weren't losing the war with microbes, which in some ways pose as big a threat to us now as they did a millennium or two ago. When the apocalypse finally arrives, it won't be because of a nuclear accident. It will be ushered in by some new bug that causes "flulike symptoms" and can't be bluffed by echinacea.

We were fairly certain that we had won the war on infectious disease as early as the fifties and sixties, when there was the feeling that we had virtually eliminated notorious killers like smallpox, polio, tuberculosis, and typhoid fever with a series of vaccines and antibiotics. So we got cocky for a couple of decades and directed our scientists to work on chronic diseases like cancer and heart disease. Then AIDS slithered out of the jungle in the early eighties, rudely reminding us that the bugs still rule.

Here in post-AIDS America, bug busting has become big business. The Southwest Foundation, a murky, quirky, and always successful private concern founded sixty years ago by eccentric San Antonio oilman-adventurer-inventor Tom Slick, is riding that wave. The foundation has long been known in scientific circles as home to the largest baboon colony in the world (about 3,600 of them, plus a couple hundred chimpanzees; as a child growing up in San Antonio, I knew it as "the monkey farm"), and it has published an estimable body of solid research in the basic sciences. But the hot lab has provided it with a ticket to the Big Show of international research science. The Southwest Foundation harvested $31 million in new grants and contracts last year, many of them to study the genetics of and antidotes for various exotic viruses with names like Venezuelan equine encephalitis and "breakbone" fever. And given that this lab is the first of its kind built west of the Mississippi, you can safely wager that they'll be hauling in more grants in the future, not only for basic research, but for more exotic assignments-like anti-bioterrorism.

"If someone receives a mysterious envelope and he needs the white powder inside tested to see if it's an unknown substance used in bioterrorism, now he calls us," said the foundation's president, former Army surgeon general Frank Ledford, Jr.

In it's present state, empty, quiet, and disheveled from its cleanup, the hot lab did not resemble anything like what I saw in the movie Outbreak; indeed, it looked a bit like my college biology lab. And in fact, much of what Patterson and others do here is the grunt work of virological research: growing microbes like the deadly arenaviruses, which cause hemorrhagic fevers, and herpes B, which can cause paralysis, and deactivating them. The crippled nucleic acid is then passed down to less-secure labs to be examined for clues to disrupt the virus' ability to replicate itself.

The deadly viruses that scientists handle here are not new, said Rebeca Rico-Hesse, a scientist at the foundation who specializes in emerging diseases, particularly in Texas. Indeed, most have been around as long as the flu. They are "emerging" now because somehow the microbial and human worlds have collided. Either we've invaded their huge, parallel universe with housing developments, golf courses, and dams, or they've acquired access to more of ours because of changes in the climate. As science essayist Lewis Thomas put it: "Disease usually results from inconclusive negotiations for symbiosis (between man and microbe), an overstepping of the line by one side or the other, a biologic misunderstanding of borders."

The southern part of Texas, especially the border, is a textbook example of this. The explosive growth in this region and the ease with which humans and animals transport diseases across the Rio Grande are the most commonly cited culprits. But the area's increasingly tropical climate may be just as important. An average daily temperature increase of just a degree a day can speed the gestation of infection from carriers such as mosquitoes.

Rico-Hesse cited three emerging viruses that could threaten Texas and are instructive about why we

continue to lose the war on bugs. Dengue fever has been cropping up sporadically in border cities like Laredo and McAllen for at least five years, having migrated from Asia to the Caribbean to South America and then northward. One effect of this arbovirus (mosquito-borne) is to cause flulike symptoms that then develop into breakbone fever, which causes joint pain so severe it feels as though your bones are breaking. But in certain cases it will advance to a hemorrhagic fever, in which the virus in effect melts down the internal organs, causing massive bleeding. The difference between a virus that causes a bad flu and one that bleeds you to death may turn out to be a single variation in the structure of the viral genome. "It took us ten years to figure that out," said Rico-Hesse. "That's part of the reason we don't have a vaccine." No wonder the bugs are winning.

Unlike dengue fever, Venezuelan equine encephalitis (VEE) does have a vaccine. That's the good news. The bad news is that the Army developed it because their experts feared that this bug might make an effective instrument of bioterrorism. This virus, similar to both Eastern and Western equine encephalitis, which also turn up in Texas, is passed by mosquitoes to horses, then to more mosquitoes, and then to humans. Though far more lethal among equines (80 percent) than humans, nonfatal encephalitis is no day at the beach. An infection of the brain, it causes symptoms ranging from headaches and tremors to convulsions and paralysis.

The new bit of treachery that VEE brings to the ecosystem is the size of its "amplifying host"--the horse. Most diseases are "reservoired" in small rodents, which at least limits the number of "vectors," such as mosquitoes, that can become infected and spread the disease. "But a horse is bigger and has so much blood," said Rico-Hesse. "This disease can be quite explosive in that way." Birds can also carry VEE, which makes its potential reach frightening. There was a serious outbreak of VEE in Texas back in 1970. After killing a lot of horses, it was quelled by the military's stockpile of vaccine. But according to Rico-Hesse, the virus continues to cause sporadic outbreaks.

A more remote but more potent threat may come from a family of bugs called arenaviruses. Another South American import, they've produced disease in only California so far, but Rico-Hesse described their effect as similar to the famous Ebola outbreak in Africa--a rapidly spreading hemorrhagic fever that kills half the people it infects. Rico-Hesse is studying sixteen strains in this hemisphere alone.

"You have to study all of them, even though only a few may be dangerous," she said with an existential shrug.

Which is one more reason why San Antonio's hot lab isn't the culmination of anything, but perhaps just the beginning. Cancer may have thrown us its best punch, but you get the feeling that the bugs have just gotten started. So it's no surprise that even as the San Antonio lab passes its first anniversary, more such labs are on the drawing board, including three in Texas: one at the University of Texas Medical Branch at Galveston, another at Texas Tech, and a third planned by Texas A&M for San Antonio's Research Park.

With new diseases emerging each year (the Centers for Disease Control and Prevention says thirty have emerged between 1973 and 1995), Patterson suspects that there will still be plenty of microbes to go around. "Somebody has to do it," she said. "Until a lot of people die, no one else pays attention to these things."

NEW HORRORS: Dengue fever, arenaviruses, and more.

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