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Suiting up: What it's like doing research in a biocontainment facility

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Written By Kristy Hentchel

"I think everyone that works on *Brucella* wishes we didn't have to work in containment. However, the reality is that *Brucella* can easily cause infection in humans," said Jonathan Willett, PhD, a postdoctoral researcher at the University of Chicago. "To prevent this, we have multiple layers of protection. All of this lets us work without fear of infecting ourselves."

Willett works in the Crosson lab at UChicago, studying the human and cow pathogen *Brucella abortus*, which causes [Brucellosis](#). Since *Brucella* is considered a 'select agent,' meaning it has the potential to pose a severe threat to public health and safety, Willett and his colleagues have to do much of their work in the [Howard T. Ricketts Regional Biocontainment Laboratory](#) at [Argonne National Laboratory](#). The Ricketts Lab is UChicago's containment facility for conducting biodefense-related and emerging infectious disease research. This work requires special handling, training and facilities for scientists to safely do their research.

"It is critical that our investigators be fully prepared to work in this hazardous environment. In addition to science-based knowledge about the host and its interaction with the pathogen in question, it is important that each scientist authorized to work in this environment be technically competent," said Joseph Kanabrocki, PhD, Associate Vice-President for Research Safety.

Research done in containment facilities across the country requires additional safety oversight and regulatory guidelines from the Centers for Disease Control (CDC), the U.S. Government, and the academic institution or national lab where the work is performed. Before scientists can even work in a containment facility they have to be fingerprinted and undergo a background check. After this clearance stage they go through hours of classroom instruction to pass written exams, followed by hands-on training by a certified biological safety professional. This training process can take 2-3 months before the researcher can be cleared to work in the facility.

"This training can only be acquired with experience and repetition of the procedures to don on and off personal protective equipment (PPE), to enter and exit the facility without breaking biocontainment, to work safely with infectious animals and to respond to accidents," said Kanabrocki.

Researchers working in containment facilities are also heavily restricted on the kinds and types of experiments they can perform. Any new experiments and protocols need to be approved by a faculty committee of experts before they are performed, assuming federal guidelines would even allow it.

"Some scientists don't understand we're prohibited to do certain types of experiments that would be allowed in most other lab environments," said Willett.

While a challenging work environment, Willett appreciates the training associated with working in containment. "As a whole, it requires you to plan out every experiment to exact detail. Working in containment makes you think about and meticulously plan out your day," said Willett.

Why *Brucella* matters

Brucellosis is transmitted from animals to humans and continues to be a major worldwide public health concern, according to the CDC and the World Health Organization (WHO). The number of reported infections in United States has dropped significantly due to animal vaccination programs and milk pasteurization.

"*Brucella*, while not much of an issue in the United States, can be a huge problem in developing countries that don't monitor and treat infected animals," said Willett. "The major cause of *Brucella* infections is contact and consumption of contaminated animals, which can be a big problem in parts of the world where people live in close contact with infected livestock."

Willett's research focuses on understanding how *Brucella* senses and responds to the different environments that exist in the host, work that he hopes could generate new therapeutics to target those pathways. "Some people question why we need to work on organisms that require such a high level of safety protocols," said Willett. "But, working on these kinds of organisms is absolutely required to develop a deep understanding of how they work, which could possibly inform new and more effective vaccines and treatments."

Suiting up

Entry into containment requires special safety gear, including layers of protective clothing and respirator. (Photos: Jonathan Willett)

The process of just entering or exiting containment typically takes around 15 minutes. First, the researchers enter an anteroom where they change into scrubs and put on their PPE, including full body, head-to-toe Tyvek suits. This PPE also includes a high-efficiency particulate (HEPA) filtered respirator, double-gloves, special shoes, shoe covers, and an additional outer layer of protective clothing.

"We all are glad that we have our own respirators and personal protective equipment because after wearing those respirators for hours on end, they can develop a specific funk that I wouldn't wish on anybody," said Willett. According to Willett, some of the hardest things about working in containment come from an unexpected corner. "You've got to develop a pretty good control of your bladder. A rookie mistake is finishing a big cup of coffee right before you enter for several hours," said Willett. "We generally try to do everything in one entry because of the cost and time incurred with each entry, so you don't want to have to exit after 20 minutes to go to the bathroom."

Before exiting the containment lab, the scientists spray themselves down with a special disinfectant, and then go through the entry process in reverse, with the additional precaution of showering before leaving the facility.

"In containment we assume everything is coated with infectious *Brucella*. So we are insanely careful to make sure that everything is disinfected routinely," said Willett. "With all of the safety protocols and facilities present at the University of Chicago at Argonne National lab, on some level I feel safer working there than I do working in a normal lab."

Willett says that people should understand that while there is risk associated with working on a pathogen like *Brucella* it actually is quite safe, and Kanabrocki agrees. "With appropriate education, equipment, training, and experience, risks associated with high biocontainment research can be effectively mitigated," said Kanabrocki. "Importantly, all investigators working in high biocontainment have a high degree of respect for their bug, their research and for each other."



The University of Chicago Medicine

5841 S. Maryland Avenue

Chicago, IL 60637 | 773-702-1000

**Appointments:
1-888-824-0200**

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