

## Fighting a Timeless Killer: Dr. William Conrad's NIH-funded battle against Tuberculosis

**Shanamon (Mieng) Chandavimol**

Lake Forest College

Lake Forest, Illinois 60045

Despite being preventable and curable, Tuberculosis (TB) was the world's leading cause of death from a single infectious disease. Even though the title of the world's leading cause of death has been held by the coronavirus disease (COVID-19) for the past 3 years, the World Health Organization (WHO) predicted that TB would reclaim its title. Causing twice as many deaths as HIV/AIDS, with up to 10 million falling ill increasingly every year, the United Nations calls for urgent action to end the global TB epidemic by 2030 (World Health Organization, 2024).

For scientists, the battle against the centuries-old disease is not just medical, but also scientific and social: how do we stop a disease that refuses to go away? At Lake Forest College, Assistant Professor of Chemistry William Conrad is taking up the challenge, and thanks to the \$425,000 grant from the National Institute of Health (NIH), his lab is now ready to push the boundaries to discover new hope. For Dr. Conrad, this is not just a milestone. It is a turning point. It is a life-changing grant.

Dr. Conrad's fascination with TB grew from his fear of infectious disease after watching the movie *Outbreak* (1995). "It is something that scared me and became what I wanted to study and understand to find new therapies," Prof. Conrad's journey with tuberculosis began in 2013 during his postdoctoral fellowship in microbiology and immunology at the University of Washington in Seattle. From there, he continued his passion with a second postdoctoral fellowship at the University of Cambridge in England. Here at Lake Forest College, he started a lab with 2 main goals in mind. First, to contribute to the TB research community, and second, to train the next generation of scientists and other professionals.

Since the 1930s, scientists have been developing some possible antibiotics against TB by studying bacteria in the lab using liquid culture or petri dishes. While it has been historically successful, Dr. Conrad believed it overlooks the realities of the disease. TB only causes problems when it is inside the human body. "I want to do something different to just see if there are other avenues where we could find antibiotics," Dr. Conrad mentioned. "In other words, the genes or the proteins that are needed for the bacteria when they are inside us". The prime suspect that could hold the key to unlocking the cure is a protein called BrkB (Bordetella resistance to complement killing gene B). In fact, BrkB is an ortholog (a descendant of a common ancestor) of *RV2707*, a disease-causing protein. "In simpler words, BrkB is the same protein but from the species *Mycobacterium smegmatis* (non-infectious to humans)," Alvaro Arroyo '26, a senior student from Conrad's Lab, explained. "Since they are so similar, conclusions on BrkB can inform us of the function of *RV2707*."

"When genetically deleting BrkB from the bacteria, it grows fine in a dish, grows fine in the flask, but does not grow in the host." Therefore, the NIH grant Prof. Conrad received is focusing on understanding BrkB with basic questions, including "What is BrkB? What does it do and how does it work? In the long term, the Conrad lab would like these discoveries to serve as stepping stones toward a therapeutic approach for tuberculosis. The NIH grant not only supports his lab but also offers Lake Forest College students a lifetime opportunity to do real science. "The funding allows me to have a bigger lab," he said.

Dr. Conrad designed a lab where each student can take ownership of a project. With that lab ecosystem, "seniors can train the new students as they develop autonomy. I am hoping to build a web project". Jeremy Levin '26, a senior student majoring in Neuroscience and Biology, mentioned how the experience of training others is "rewarding, challenging, and

makes me a better scientist". In addition, with a passion for working in the Medical field, "This trains me to communicate complicated topics with others, which in my future would be the patients." Further and detailed information about the lab is available on <https://www.theconradlab.com>.

Part of Dr. Conrad's grant also supports an in-class lab, CHEM 305: Advanced Biochemistry, which would be offered during the semester. The goal of this class is to continue where Dr. Conrad left off in his postdoc: the ESX secretion system. Specifically, the in-classroom lab will focus on the enzyme in the system, called the protease, which is highly "druggable". Many advanced protocols will be used in the lab, including purifying the protease, performing enzyme inhibition assays, and applying computational chemistry, such as modeling the protease's 3D structure. "It is so exciting about how and where we are living right now. Computational chemistry and biochemistry are growing so much, and it is democratizing science," Dr. Conrad commented.

Ultimately, what he hopes students will gain goes beyond technical knowledge. Dr. Conrad highlighted 3 important questions about science - questions he believes should always stay at the back of his students' minds as they pursue science. What is the problem? What do you want to solve? And what are some steps to solve the problems? "I don't want all of my students to end up being tuberculosis or even an infectious disease researcher. I want them to take the lessons of what we do in the lab and find the right tools to solve the problem elsewhere."

Despite the NIH grant's impact, Dr. Conrad is deeply aware of the fragile landscape of research funding in the US, which he argues is essential to global scientific progress. "Just like ATP is the powerhouse of the cell, the NIH is the powerhouse of scientific research around the world - Republican or Democrat, immigrant or non-immigrant, disease affects us all." His NIH grant currently supports more than a dozen students on campus; without it, his lab would not survive. "If my funding were taken away, I would have to shut down my lab. It would be devastating", he admitted. "My only wish and hope is that people keep speaking their truth out into the world, we benefit from fighting the disease. We need to stand up for science".

The fight against Tuberculosis is one of humanity's longest wars, but Dr. Conrad sees a path forward. Because this disease survives only in humans, not in water, soil, or other animals, he strongly believes eradication is possible. "TB has been very effective at evolving against whatever new things that we give to it". For Dr. Conrad, victory is not just advancing TB research but preparing the next generation of scientists to solve the problems that matter.



**Figure 1.** The Conrad Lab.

*Note: Eukaryon is published by students at Lake Forest College, who are solely responsible for its content. This views expressed in Eukaryon do not necessarily reflect those of the College. Articles published within Eukaryon should not be cited in bibliographies. Material contained herein should be treated as personal communication and should be cited as such only within the consent of the author.*

**References:**

1. World Health Organization. (2024). Global tuberculosis report 2024. World Health Organization. <https://www.who.int/publications/i/item/9789240101531>