**A Current Effort to Fight Tuberculosis**

India is currently home to around 1.43 billion people. According to the National

Prevalence Survey of India (2019-2021), around 31% of Indians are burdened by Tuberculosis (TB), the deadliest bacterial disease in the world (Chauhan et. al., 2023). Out of every country on the planet, India faces the most burden caused by TB. The National Strategic Plan 2017-2025 for Ending TB wishes to try to end the TB epidemic in India by 2025, but some of the efforts within it are undervalued. Even with efforts from the Indian government, TB remains rampant. This is what Dr. Avi Mitra, an assistant professor at Oklahoma State University, observed while growing up in India.

“Growing up in India, I first had observed many family members and friends overcoming TB infections,” he says. “These experiences made me interested in pursuing some sort of research with *Mycobacterium tuberculosis* (*Mtb*).” *Mtb* is the causative bacterium of Tuberculosis infection. Today at Oklahoma State, Dr. Mitra leads a research team of graduate and undergraduate students studying this bacterium.

Dr. Mitra says, “Our research is focused on understanding how the lung pathogen *Mycobacterium tuberculosis* get iron nutrients from the human host during infection.” All living things, from plants, to humans, to single-celled bacterial pathogens, need similar nutrients to survive. One of these is iron, which can be found in human red blood cells, specifically heme in hemoglobin. When *Mtb* infects a human host, no matter if it is a latent or active infection, it acquires iron via heme in red blood cells to help it survive and thrive.

So why study the molecular pathways in which *Mtb* acquires iron? Recent discoveries by Dr. Mitra’s lab, as reported by Dr. Mitra, explain this. “Our recent discovery showed that to transport heme iron in the *Mtb* cytoplasm, *Mtb* uses a unique class of proteins as heme iron transporters which are only found in pathogenic *Mycobacteria*. Because these proteins are only found in pathogenic *Mycobacteria*, they could serve as highly specific drug targets to treat TB infections.” (A. Mitra, personal communication, April 2, 2024)

A major issue with not only Tuberculosis, but many bacterial infections, is antibiotic resistance. The bacterium’s genetic material mutates in a way that makes the cell incapable of being killed by more commonly used antibiotics. Because of this, and how prevalent TB is in many countries like India, there are many research efforts around the world to find new drug targets and treatments to fight TB. This is why Dr. Mitra’s discovery of this unique class of proteins only found in *Mycobacteria* is so important. Also, along with projects studying the proteins involved in iron acquisition, Dr. Mitra’s lab has a “drug discovery project in identifying molecules that can prevent iron acquisition in bacterial pathogens.” So, there are two overall projects in Dr. Mitra’s lab: one that studies the actual molecular mechanisms in which *Mtb* takes up iron from heme and one that studies possible ways to inhibit these mechanisms to treat TB infections.

“Both projects have the potential in identifying novel chemotherapeutics to treat bacterial infections,” says Dr. Mitra. While research in molecular microbiology and drug development can take a very long time, every effort matters. Any development in understanding any mechanism in which *Mtb* survives, not just iron acquisition, can lead to the next treatment against Tuberculosis, and hopefully aid in the end of the Tuberculosis epidemic in many countries, including Dr. Mitra’s home country of India.

**Citations**

Chauhan, A., Parmar, M., Dash, G. C., Solanki, H., Chauhan, S., Sharma, J., Sahoo, K. C., Mahapatra, P., Rao, R., Kumar, R., Rade, K., & Pati, S. (2023). The prevalence of tuberculosis infection in India: A systematic review and meta-analysis. *The Indian journal of medical research*, *157*(2&3), 135–151.

<https://doi.org/10.4103/ijmr.ijmr_382_23>