

Sustained-release rifampicin crystalline formulation for patient compliant treatment of tuberculosis

Rachit Agarwal

Centre for BioSystems Science and Engineering

Indian Institute of Science

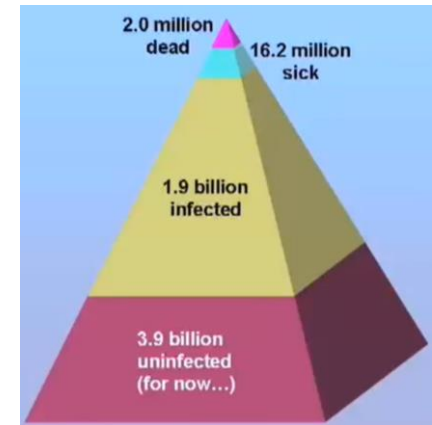
rachit@iisc.ac.in

<http://www.be.iisc.ac.in/~rachit/>

 @Rachit_Agarwal

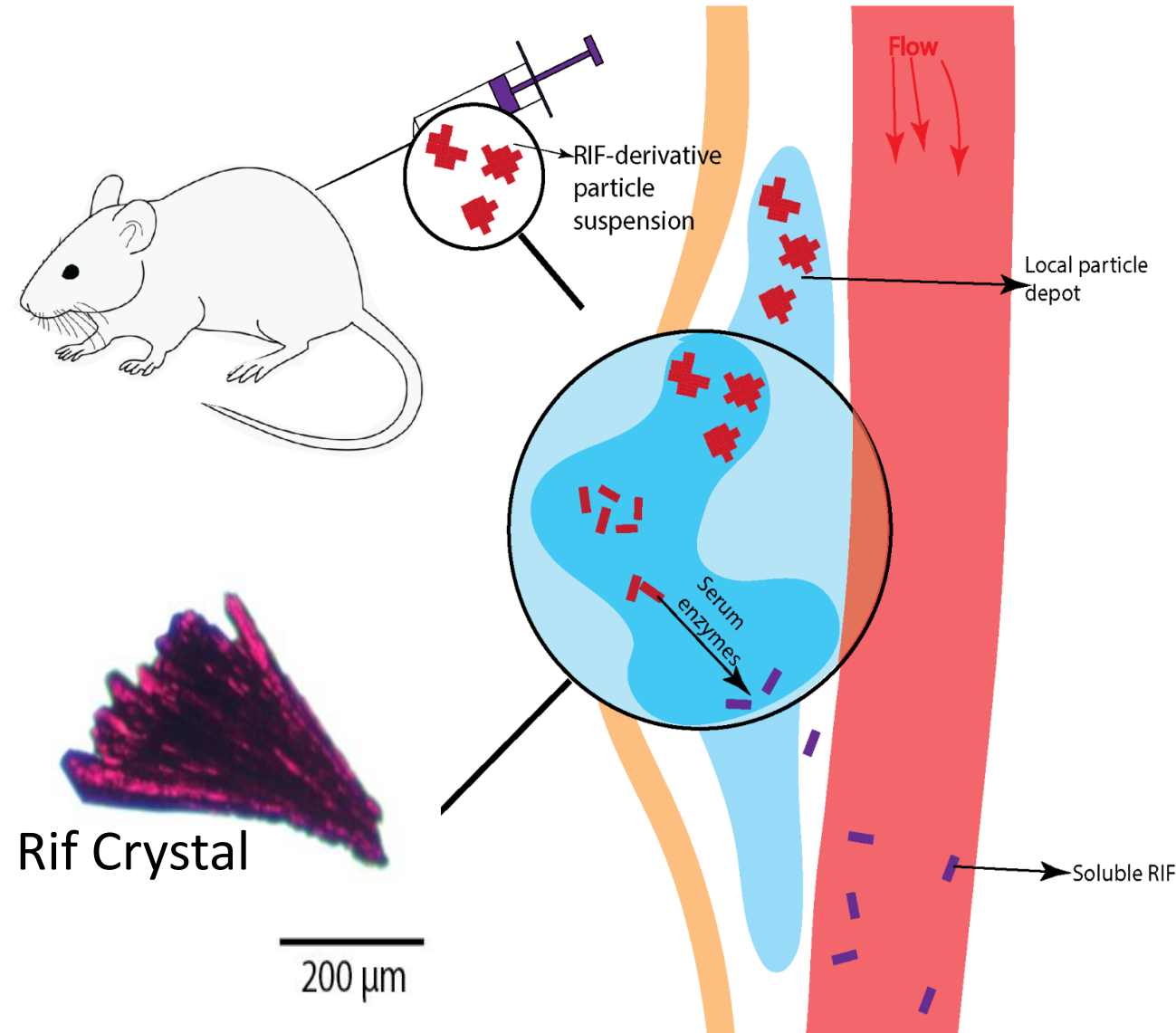
Tuberculosis Lung infections

- Mycobacterium Tuberculosis (MTB) **infects nearly a third of human population**
- 10 million new TB cases each year
- Long treatment: 6-12 months
- Almost 40% patients globally do not complete self-administered therapy
- 5% had **Multi-Drug Resistant (MDR) TB**
 - India has highest MDR cases in world
- Need to shorten the TB treatment and increase patient compliance



Concept and overall system

- Can we develop an injectable crystallized drug that slowly dissolves in the system over a period of a month and only require 4 to 6 doses?
- Crystals can be synthesized using liquid-antisolvent precipitation
- Chemically modify the drug to improve crystallization and dissolution



Learnings and major techniques

Students working on this project will develop following expertise:

- Problem solving ability and time management!
- Engineering materials for biological applications
- Designing nanoparticles with various polymers and lipids (liposomes)
- Drug crystallization and strategies for sustained and controlled release of drugs
- Microscopic techniques such as fluorescence imaging, Scanning and transmission electron microscopy
- Mammalian and bacterial cell culture, animal handling
- Working with clinical samples and in biosafety level 3 facilities

Further reading

Farah S, Doloff JC, Muller P, Sadraei A, Han HJ, Olafson K, et al. Long-term implant fibrosis prevention in rodents and non-human primates using crystallized drug formulations. *Nat Mater* 2019;18:892-904.

<https://www.nature.com/articles/s41563-019-0377-5>

D'Addio SM, Reddy VM, Liu Y, Sinko PJ, Einck L, Prud'homme RK. Antitubercular Nanocarrier Combination Therapy: Formulation Strategies and in Vitro Efficacy for Rifampicin and SQ641. *Mol Pharm* 2015;12:1554-63. <https://pubs.acs.org/doi/10.1021/mp5008663>