

Phage-particles for treatment of tuberculosis infections

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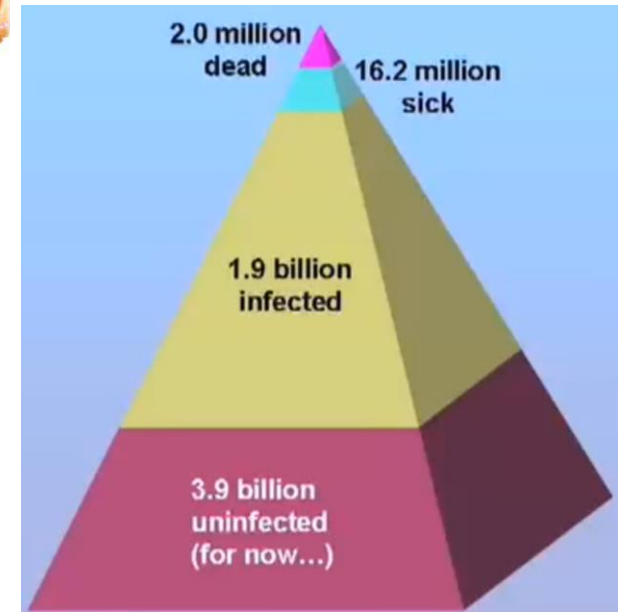
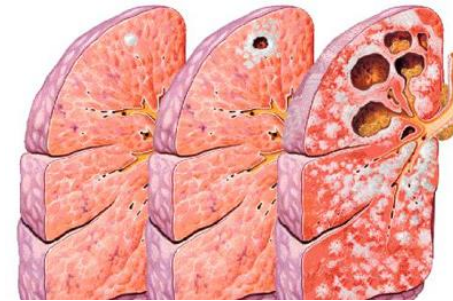
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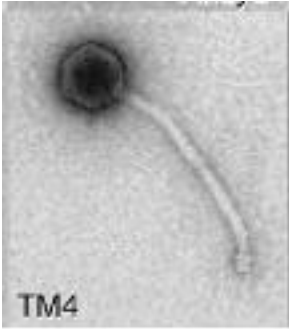
Tuberculosis Lung infections

- Mycobacterium Tuberculosis (MTB) **infects nearly a third of human population**
- 10 million new TB cases each year
- 5% had **Multi-Drug Resistant (MDR) TB**
 - India has highest MDR cases in world
- **Total Drug Resistance (TDR) also reported in India**
 - Resistant against all clinically used antibiotics
- Long treatment: 6-12 months
- Macrophages uptake MTB but fail to fuse phagosome with lysosome
- Bacteria resides intracellularly and escapes lethal doses of traditional antibiotic treatment



Dry powder microparticle carrier for phage delivery

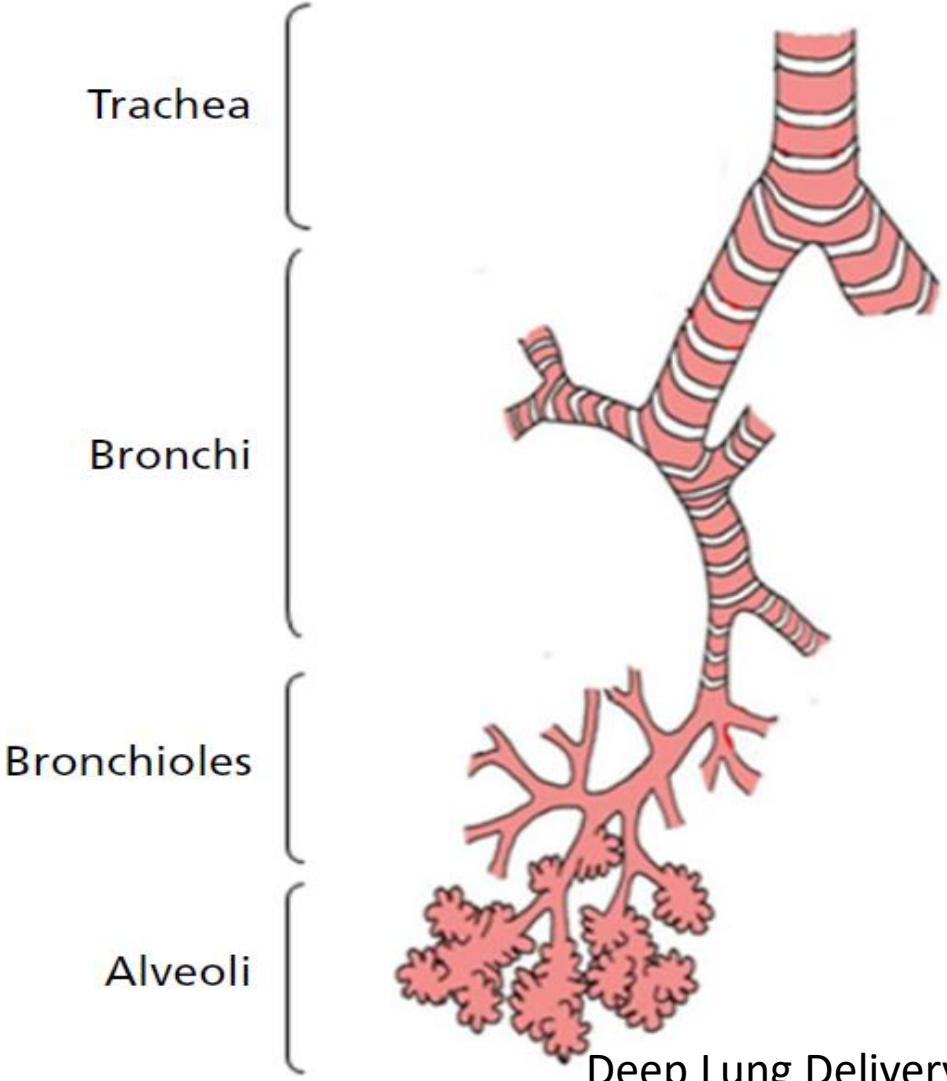
- Bacteriophage loaded on particles
- Dry powder formulations
- Deep lung delivery



● Carrier for deep lung delivery
★ Drug/Bacteriophage

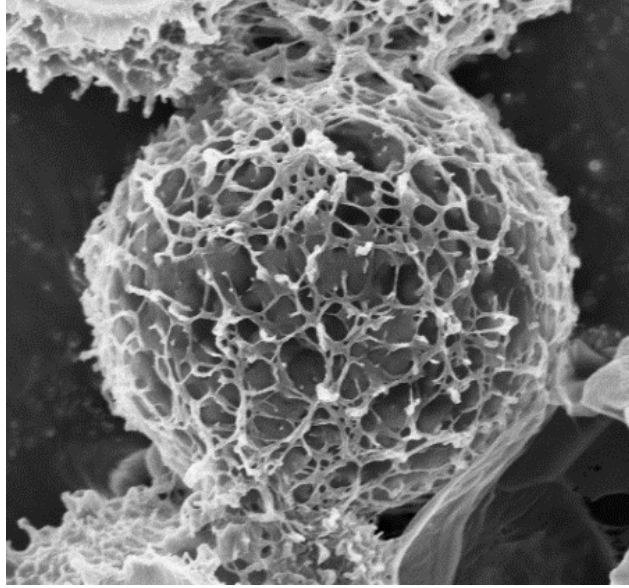


Dry Powder Inhalers

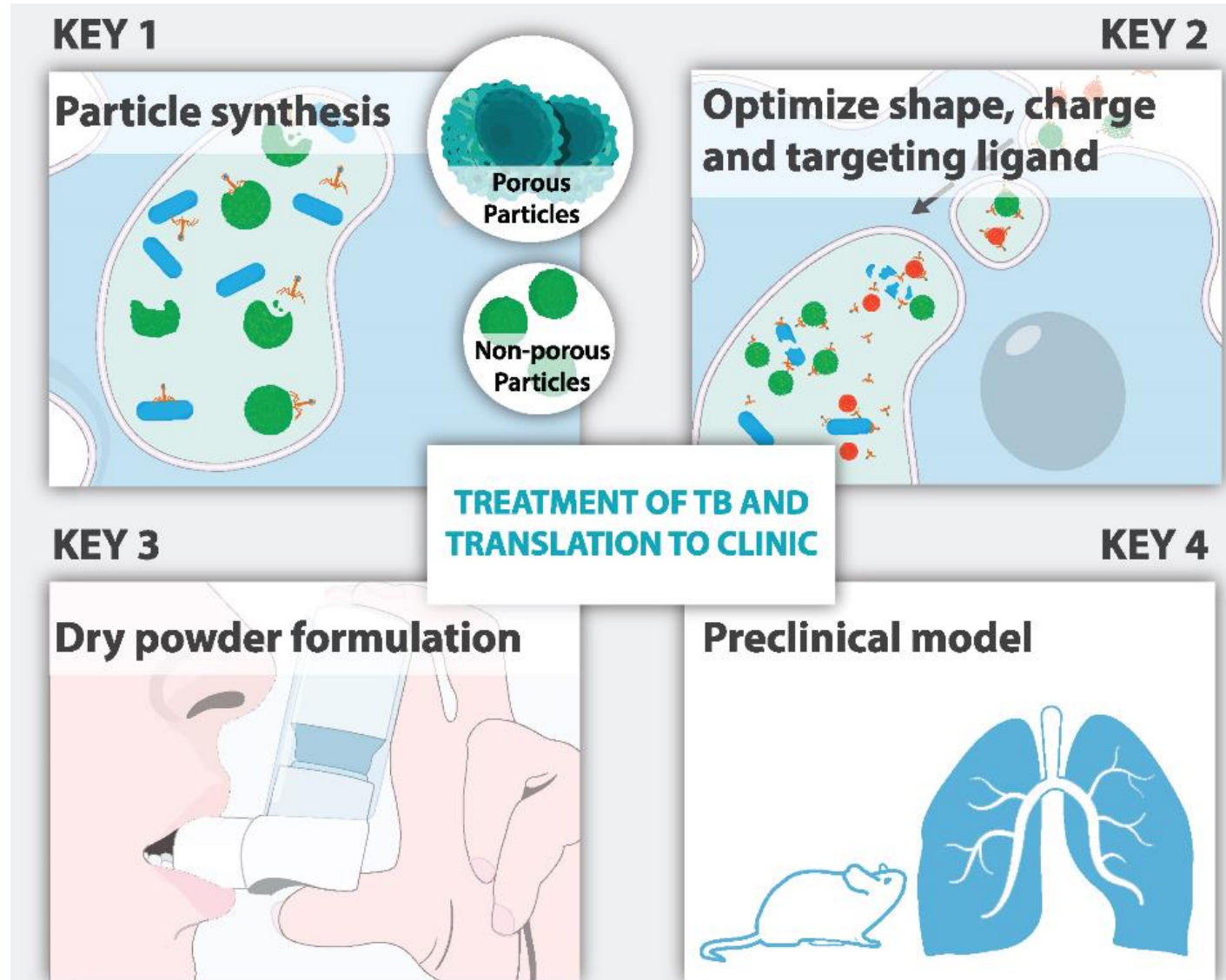


Overall system

Porous & hollow microparticles

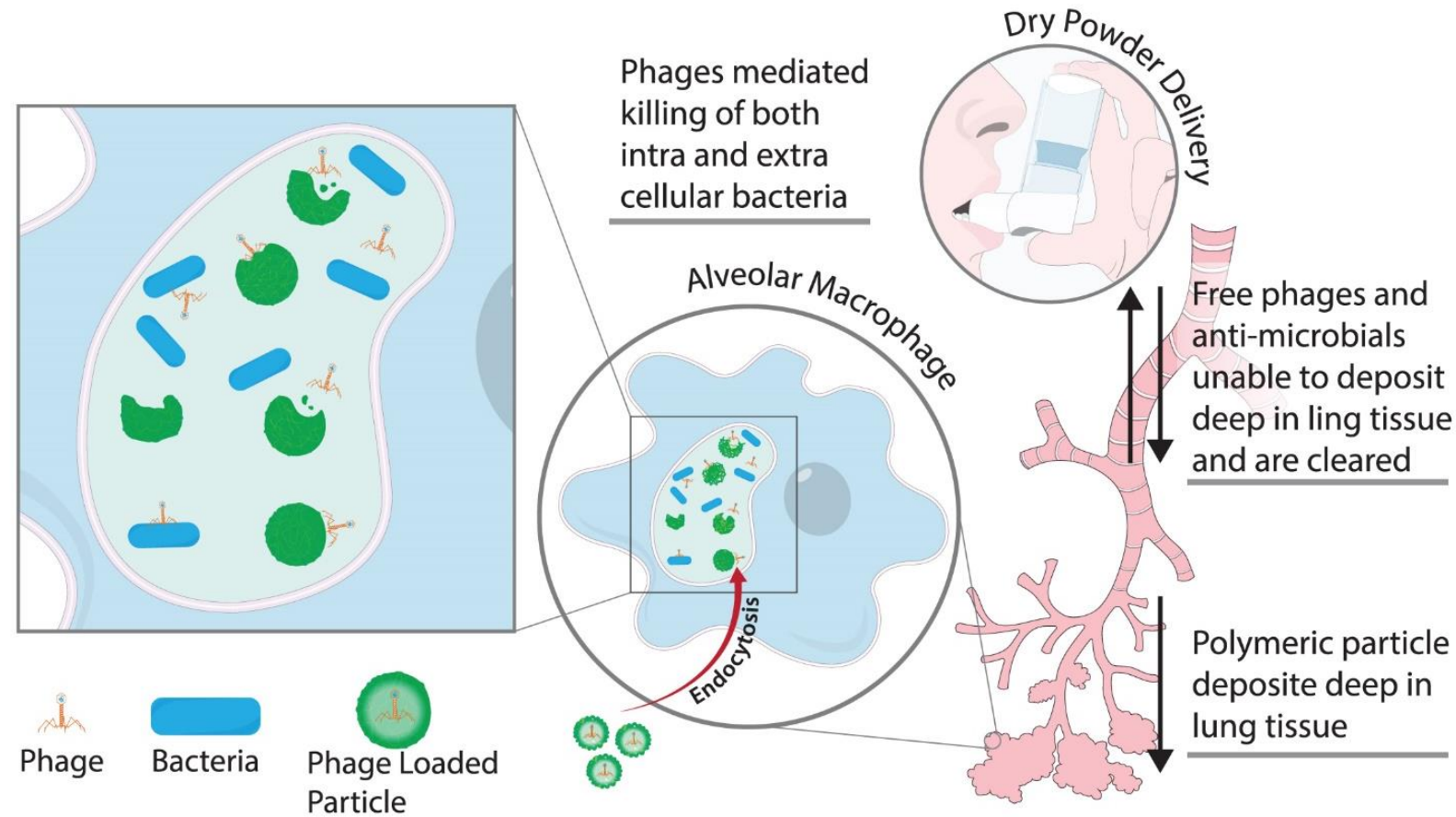


Bacteriophages infecting bacteria



Treatment of MTB lung infections

- Co-delivery of porous and non-porous drug carriers to treat TB
- Effective against sensitive and drug resistant TB and also prevent its spread
- **Rapid translation** to clinics and **high patient compliance** with dry powder formulations



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)
- Encapsulating drugs and strategies for sustained and controlled release of drugs
- Bacteriophage-bacterial dynamics
- 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

Agarwal R, Johnson CT, Imhoff BR, Donlan RM, McCarty NA, García AJ. 2018. Inhaled bacteriophage-loaded polymeric microparticles ameliorate acute lung infections. *Nature Biomedical Engineering* 2:841-849.

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