

Micro- and Nano-Carriers for Treatment of Tuberculosis Lung Infections

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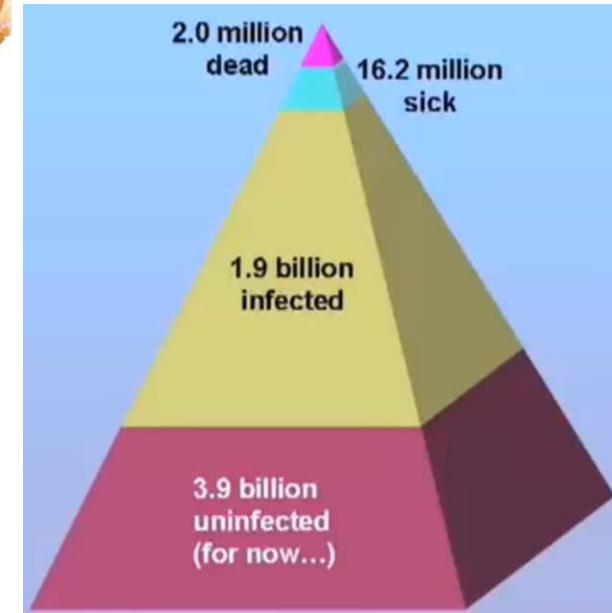
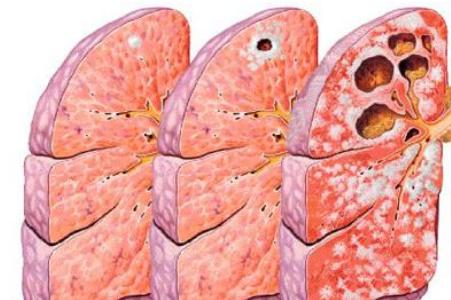
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Tuberculosis Lung infections

- 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

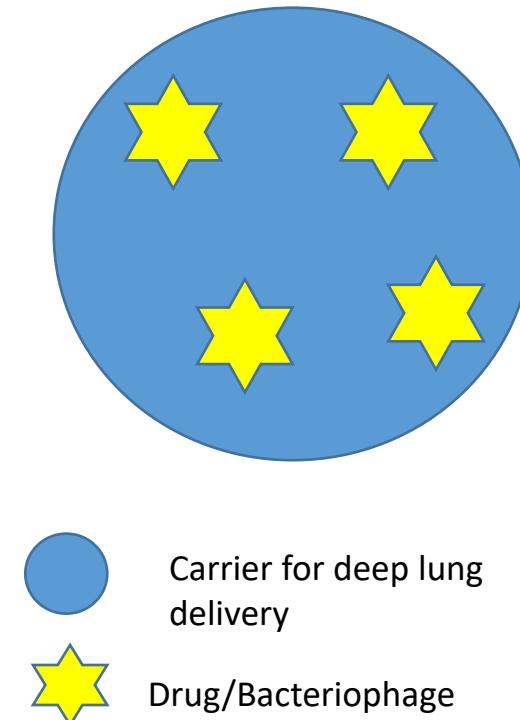


Dry powder microparticle carrier for phage delivery

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



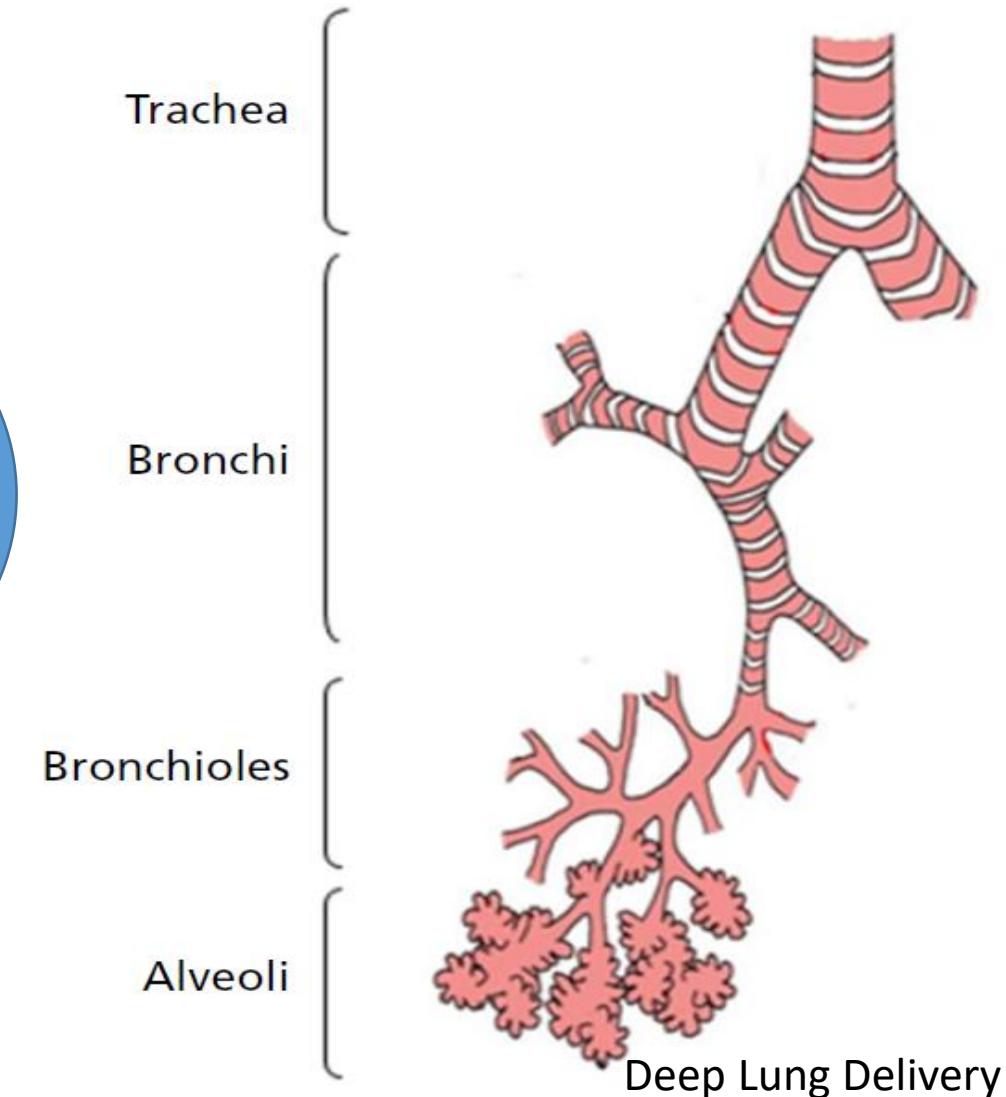
Dry Powder Inhalers



Carrier for deep lung delivery



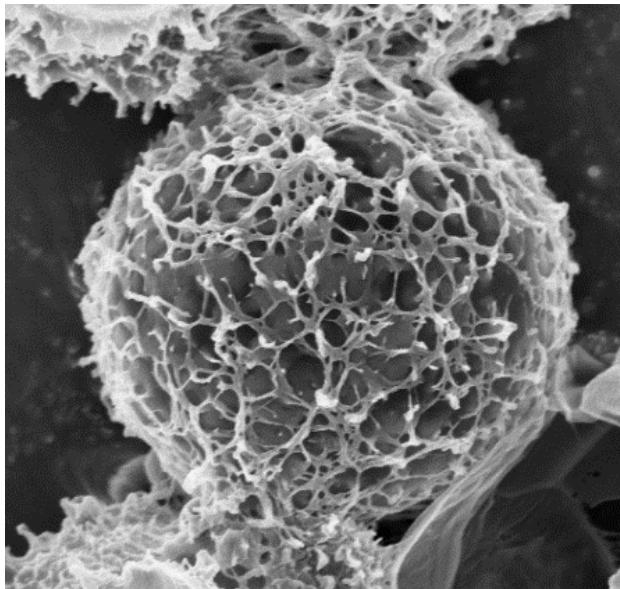
Drug/Bacteriophage



Deep Lung Delivery

Overall system

Porous & hollow microparticles

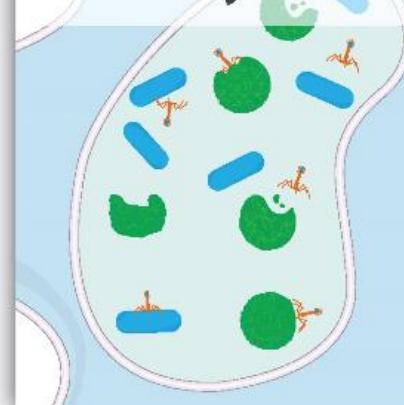


Bacteriophages infecting bacteria



KEY 1

Particle synthesis

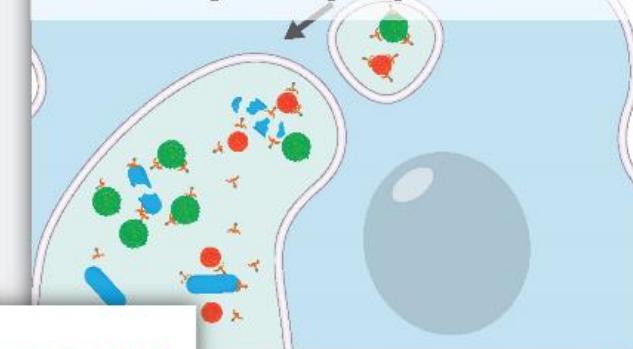


Porous
Particles

Non-porous
Particles

KEY 2

Optimize shape, charge and targeting ligand



KEY 3

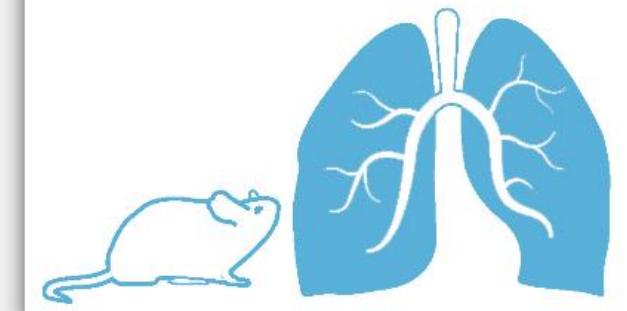
TREATMENT OF TB AND
TRANSLATION TO CLINIC

Dry powder formulation



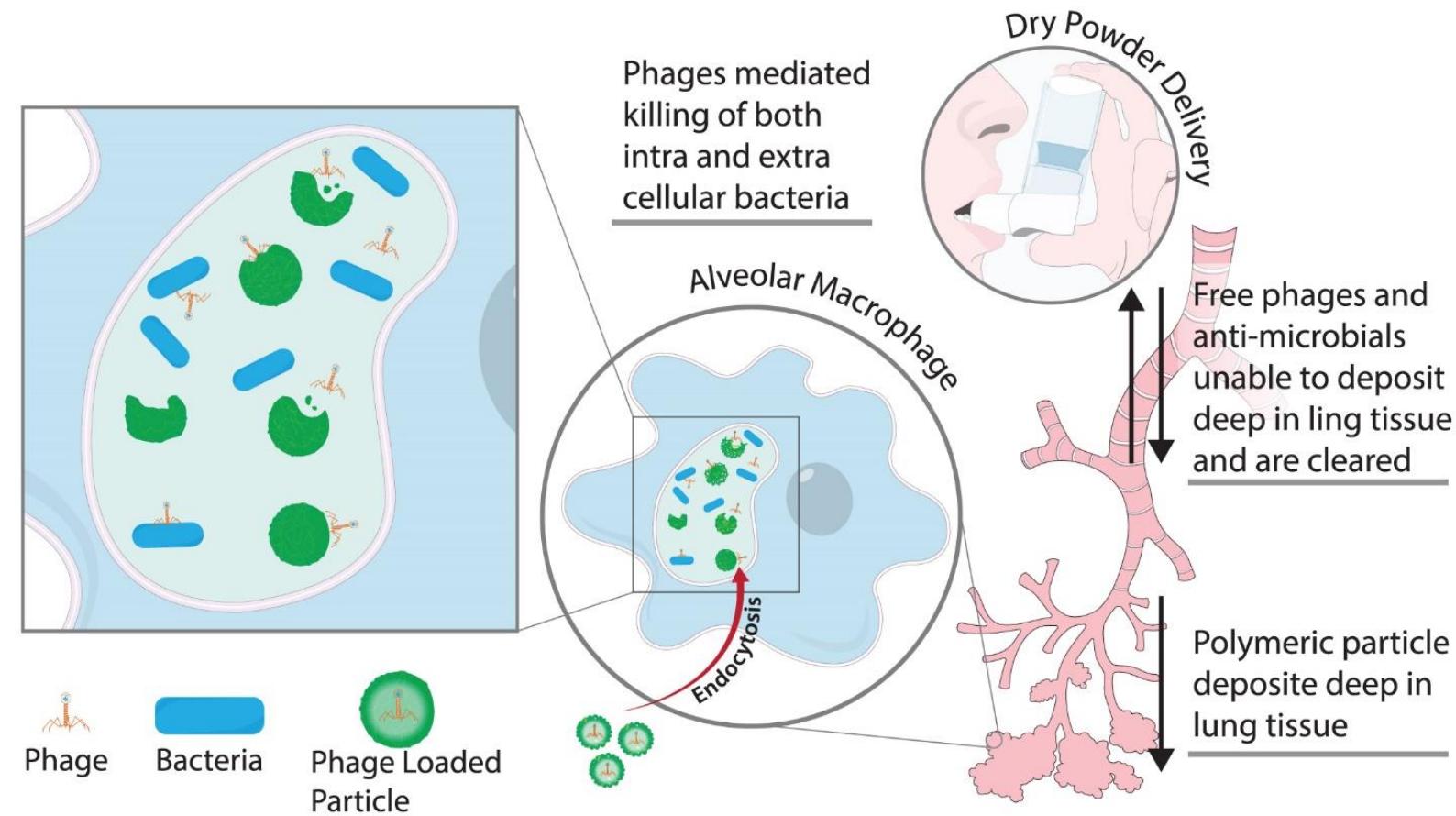
KEY 4

Preclinical model



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



Major Techniques

- Mammalian and bacterial cell culture
- Engineering nano- and micro-carriers
- Characterization of charge and size (DLS, SEM etc.)
- Rodent and clinical samples handling
- Working 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.