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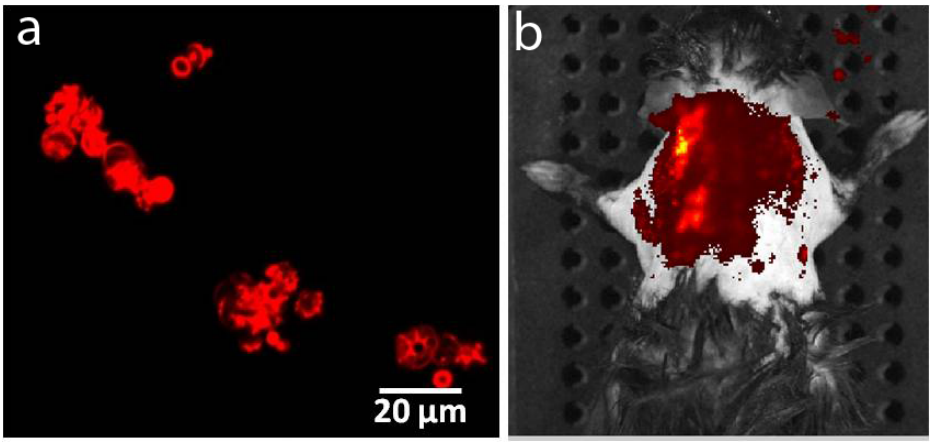
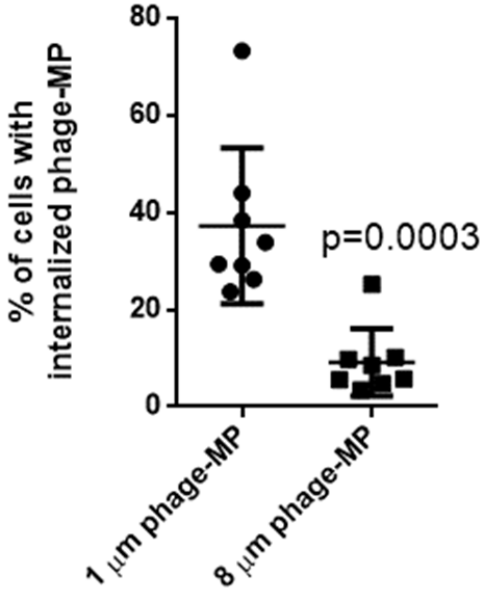
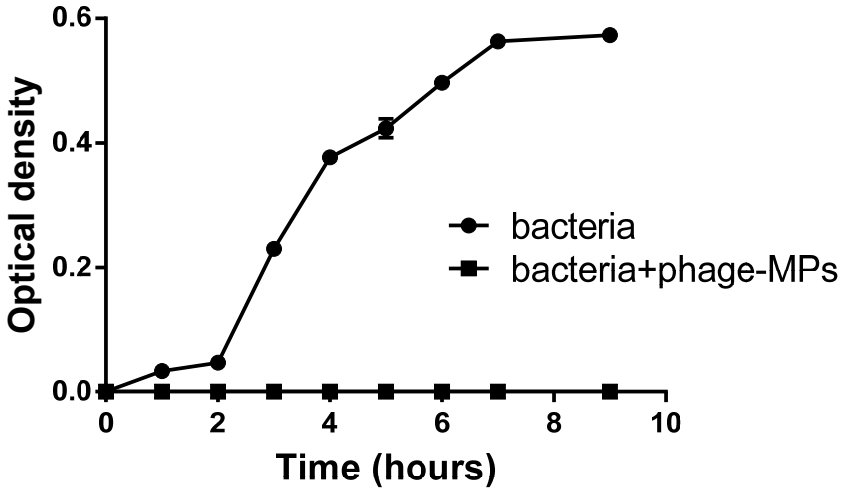


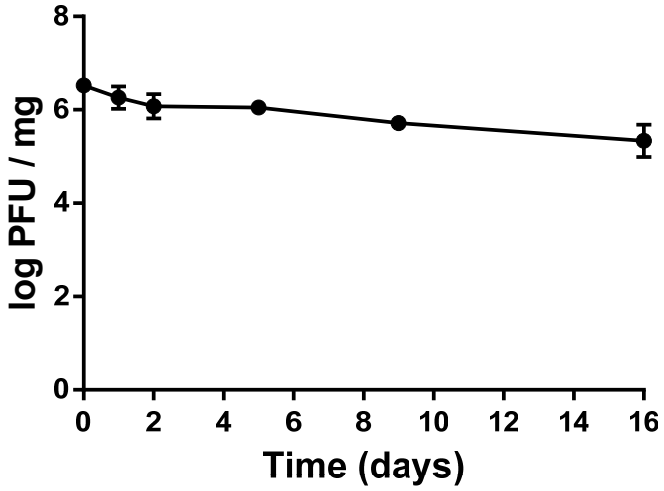
Supplementary Figure 1. Dry powder formulations of porous MPs resulted in lung delivery of MPs via inhalation. a, Confocal fluorescence microscopy of porous and hollow MPs. **b,** Fluorescence imaging (using the IVIS system) of live mouse after MP administration via lung insufflation. Data were collected on male C57BL/6 mice.



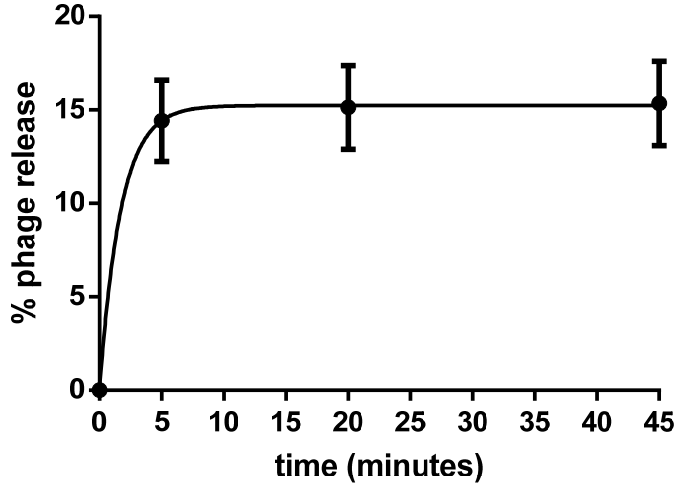
Supplementary Figure 2. MP internalization by macrophages depends on size of particles. Percentage of RAW264.7 macrophage cells with internalized phage-loaded microparticles for two different particle sizes. . Measurements (n=8/group, mean ± SD) were taken from biologically independent samples from two separate runs. Two-tailed Mann-Whitney test was used for comparing differences between groups.



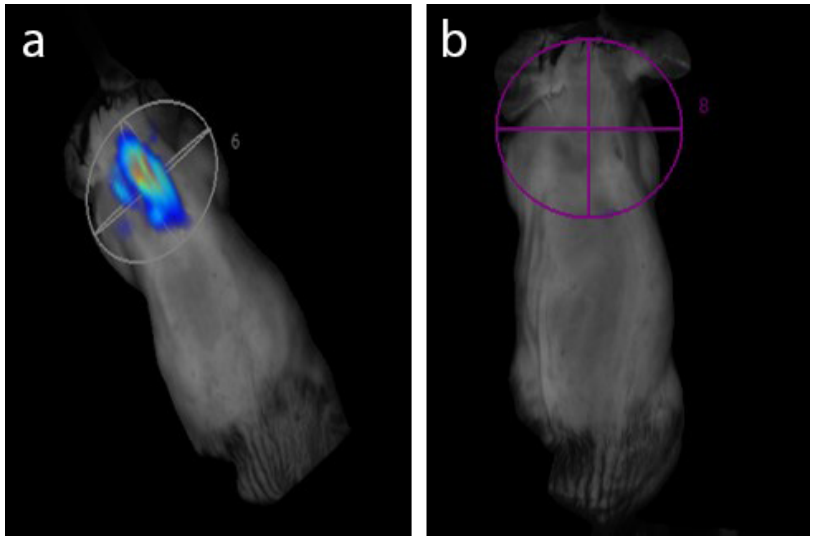
Supplementary Figure 3. Phage-MPs prevent growth of bacteria in synthetic sputum. Growth curve of PA103 bacteria in synthetic sputum in presence or absence of phage-MPs. Measurements (mean ± SD) were taken from 3 biologically independent samples.



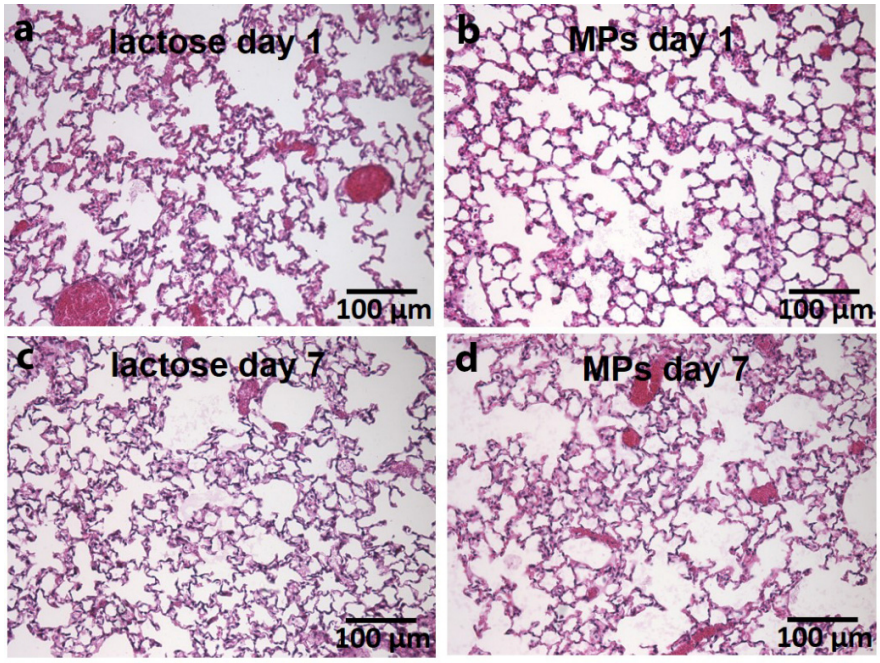
Supplementary Figure 4. Dry powder formulations of phage-MPs stored at room temperature retain phage activity over several days. Dry powder formulations of phage-MPs were prepared by lyophilization and stored at room temperature. Active phage on phage-MPs was periodically enumerated on PA103 (n=3 biologically independent samples, mean ± SD).



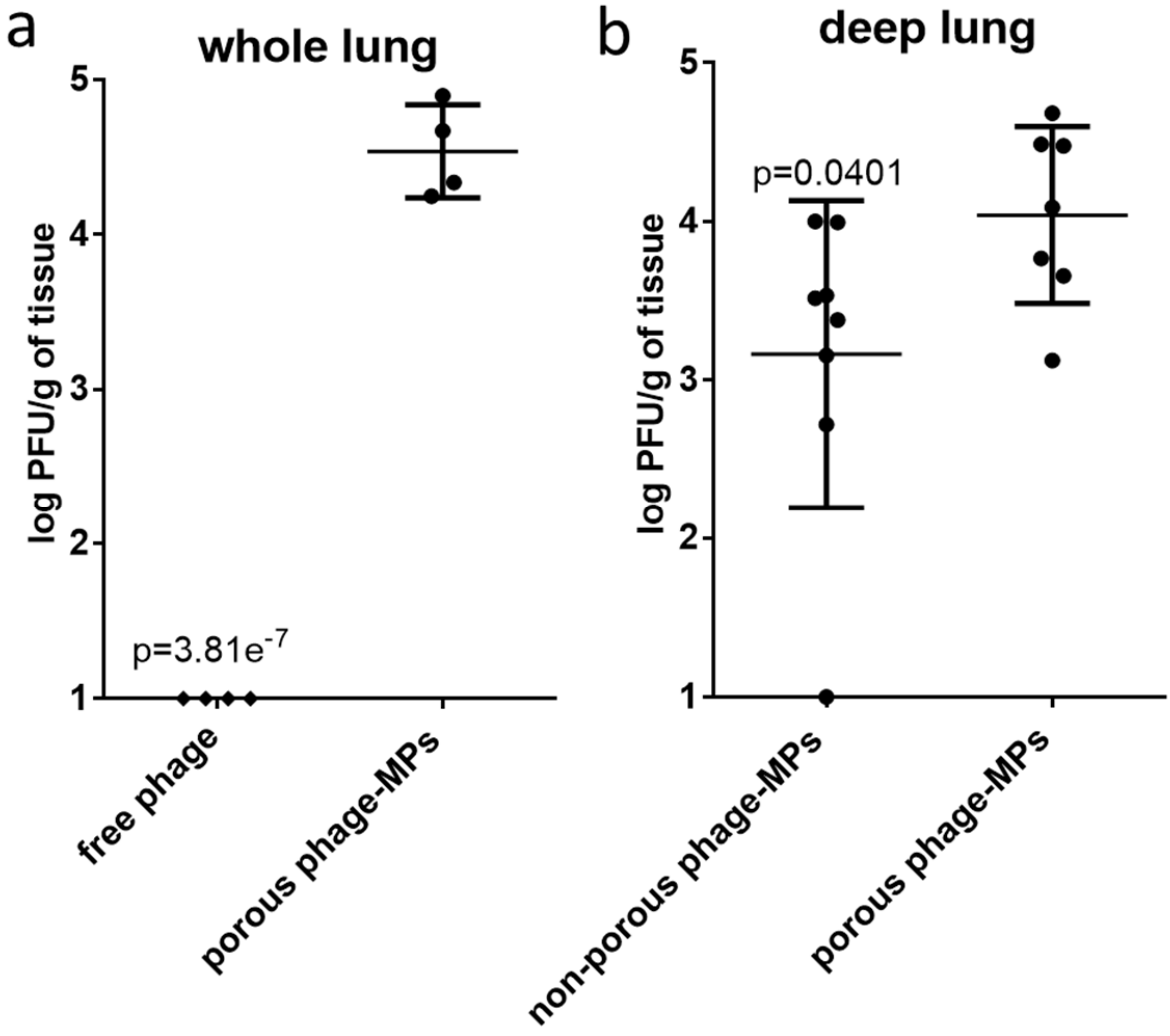
Supplementary Figure 5. Release of phage from dry powder formulation. Phage release was measured for 45 minutes after suspending the particles in PBS. Data were pooled from two independent experiments. Measurements (n=6/group, mean ± SD) were taken from distinct samples.



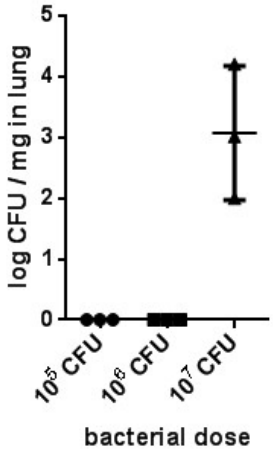
Supplementary Figure 6. MPs are cleared from the lungs by 18 h. Fluorescence molecular tomography images at (**a**) 0 h and (**b**) 18 h of live mouse insufflated with fluorescent MPs. Data were collected on male C57BL/6 mice.



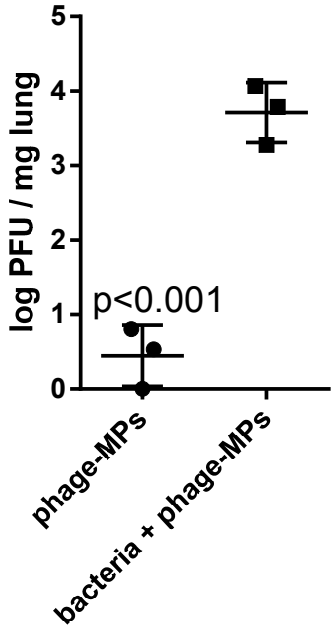
Supplementary Figure 7. MPs elicit minimal inflammation in the lungs of wild-type mice. Images of histological sections of mouse lungs stained with H&E at 1 day after treatment with (**a**) lactose only, (**b**) MPs + lactose. Images of histological sections of mouse lungs stained with H&E at 7 days after treatment with (**c**) lactose only, (**d**) MPs + lactose. Data were collected on male C57BL/6 mice.



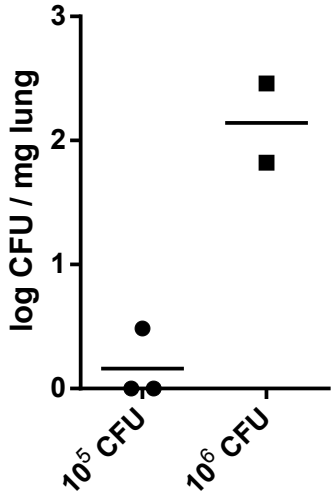
Supplementary Figure 8. Porous MPs are required for efficient and deep deposition of active phage to lungs. a, Recovery of active phage from mouse lungs immediately after phage insufflation with or without porous MPs (n=4/group, mean ± SD). Two-tailed t-test was used to detect statistical differences. **b,** Recovery of active phage from deep lungs after phage insufflation with non-porous or porous MPs (n=8 mice for non-porous phage-MPs, n=7 mice for porous phage-MPs, mean ± SD). Phage load in lung homogenate was quantified immediately after insufflation. A two-tailed Mann-Whitney test was used to detect statistical differences. Data were collected on male C57BL/6 mice.



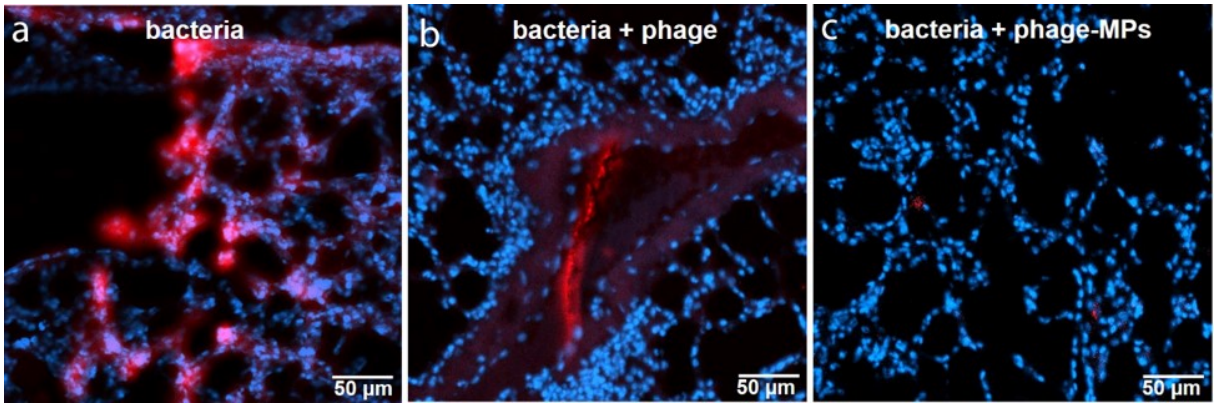
Supplementary Figure 9. High dose of PAO1-GFP bacteria results in persistent infection after 24 h in wild-type mice. Data (n=3/group, mean ± SD) were collected on male C57BL/6 mice.



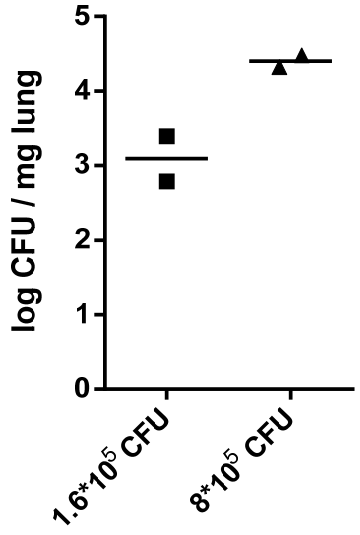
Supplementary Figure 10. Phage-MPs respond to bacterial infection resulting in phage propagation. Delivery of phage-MPs was examined in a healthy lungs and lungs infected with *P. aeruginosa* (PAO1-GFP). After 18 h of treatment, the phage load in lung homogenate was quantified. Data (n=3/group, mean ± SD) were collected on both male and female wild-type CFTR littermates. Measurements were compared using two-tailed t test.



Supplementary Figure 11. High dose of PAO1-GFP bacteria results in persistent infection after 18 h in CFKO mice. Bacterial load in lung homogenate was quantified (n=3 mice for 10^5 CFU, n=2 mice for 10^6 CFU). The line between the points represents mean. Data were collected on both male and female CFTR knockout mice.



Supplementary Figure 12. Phage-MPs reduce bacterial infection in CFKO mice. Images of immunohistochemistry sections of mouse lungs stained with DAPI (blue) and anti-*P. aeruginosa* antibody (red) 18 h after treatment with (**a**) bacteria only, (**b**) bacteria + phage and (**c**) bacteria + phage-MPs. Data were collected on both male and female CFTR knockout mice. These are representative images from a total of 14 images taken.



Supplementary Figure 13. Effect of PA103 dose was examined in mouse lungs after 18 h of bacterial inoculation in wild-type mice. The bacterial load in lung homogenate was quantified (n=2 mice). The line between the points represents mean. Data were collected on both male and female wild-type CFTR littermates.

Supplementary Table 1. Phage and respective host used for phage amplification for treatment of PAO1-GFP infection.

Phage	Host bacteria used
ØPaer4	PsAer-2
ØPaer14	PsAer-9
ØPaer22	PsAer-10
ØW2005-A	EAMS2005-A
ØE2005-C	EAMS2005-C

Supplementary Table 2. *In vitro* evaluation of phage-MPs using spot assay against clinically isolated *P. aeruginosa* strains from patients. Strains were freshly isolated from local patients, while the PA103 strain is a historical patient isolate. All strains were non-mucoid. CFBR 337 and CFBR 505 are tobramycin-resistant strains. Phage-MPs were termed as effective against a strain of bacteria if it successfully if distinct plaques were generated with that strain.

Strain	Infection type	Phage-MPs effective?
1501355	Acute	Yes
1604085	Acute	Yes
1701103	Acute	Yes
1701094	Acute	Yes
1701088	Acute	Yes
1701095	Acute	Yes
PA103	Historical	Yes
CFBR 263	CF	Yes
CFBR 337	CF	Yes
CFBR 388	CF	No
CFBR 496	CF	Yes
CFBR 505	CF	Yes
CFBR 530	CF	Yes

Supplementary Table 3. Phage and respective host used for phage amplification for treatment of clinical strain (PA103) infection.

Phage	Host bacteria used
ØPaer22	PA103
ØE2005-C	PA103
Ø109	PA103