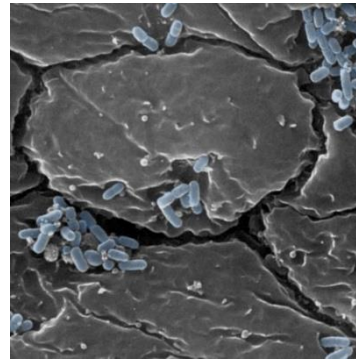
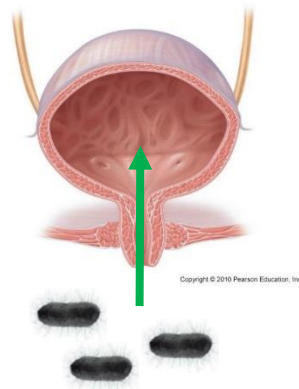
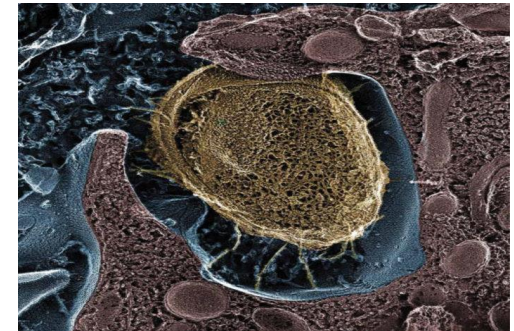


Pathogenic bacteria infect bladder with strongly adhering bladder epithelial cells

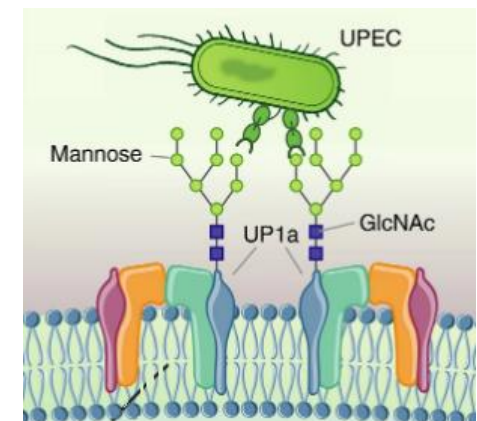


Apodaca GL



Hultgren SJ

- Primary causative agent of cystitis
- Approximately 85 % of all UTIs
- Pathogenic *E.coli*
 - Mostly characterized as extracellular pathogens
- Intracellular location of UPEC provides
 - Better protection from well-known antibiotics
 - Ex) Gentamicin, Ciprofloxacin and Trimethoprim-Sulfamethoxazole



Immunology. 2021 Sep;164(1):3-14.

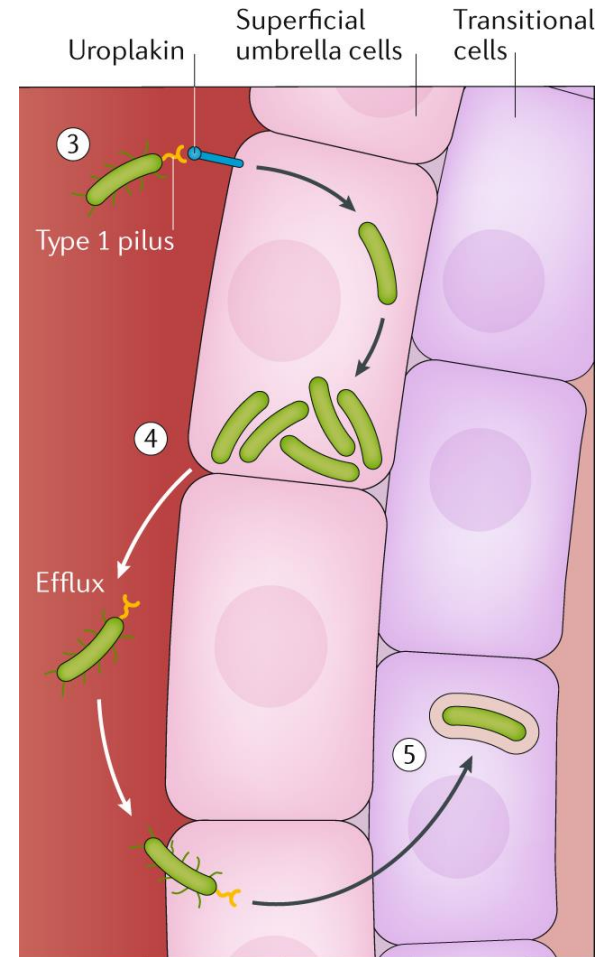
Recurrent UTIs via persistent bacterial infection?

- Recurrent infection: One in four chances within 6 months of bacterial clearance despite antibiotic treatment

Foxman and Brown, 2003

- Interestingly, a large percentage of recurrent infections are caused by the same bacterial strain as the initial infection and can occur up to one year after the initial infection

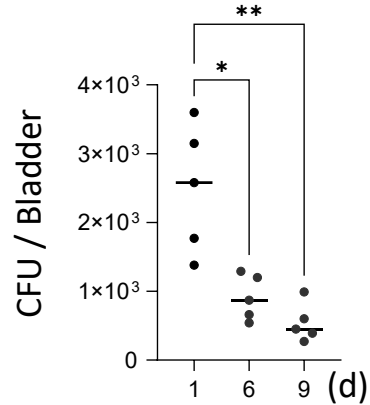
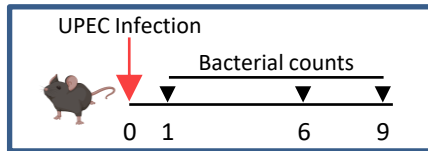
Russo et al., 1995



Sihra N, et.al, (2018) Nat Rev Urology

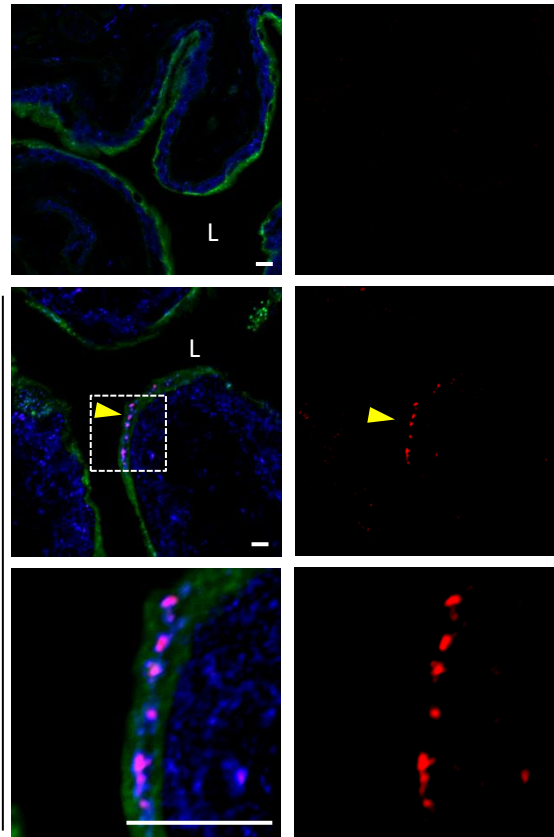
**Intracellular persistence of Uropathogenic
E. coli prevents antibacterial effect**

Persistence of UPEC within bladder epithelial cells in vivo mouse model and rUTI human tissue

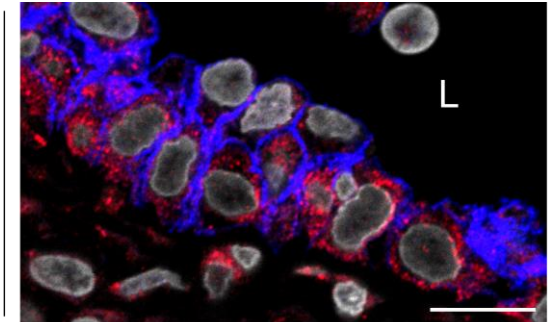


Vehicle

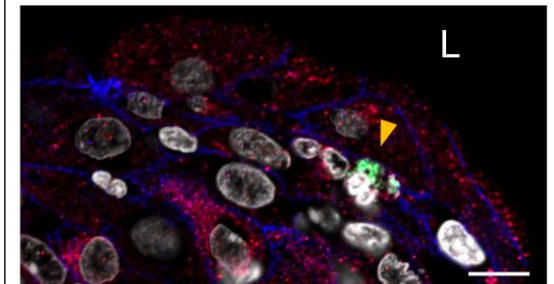
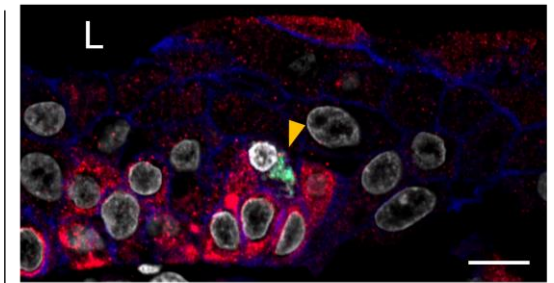
9 d (p.i.)



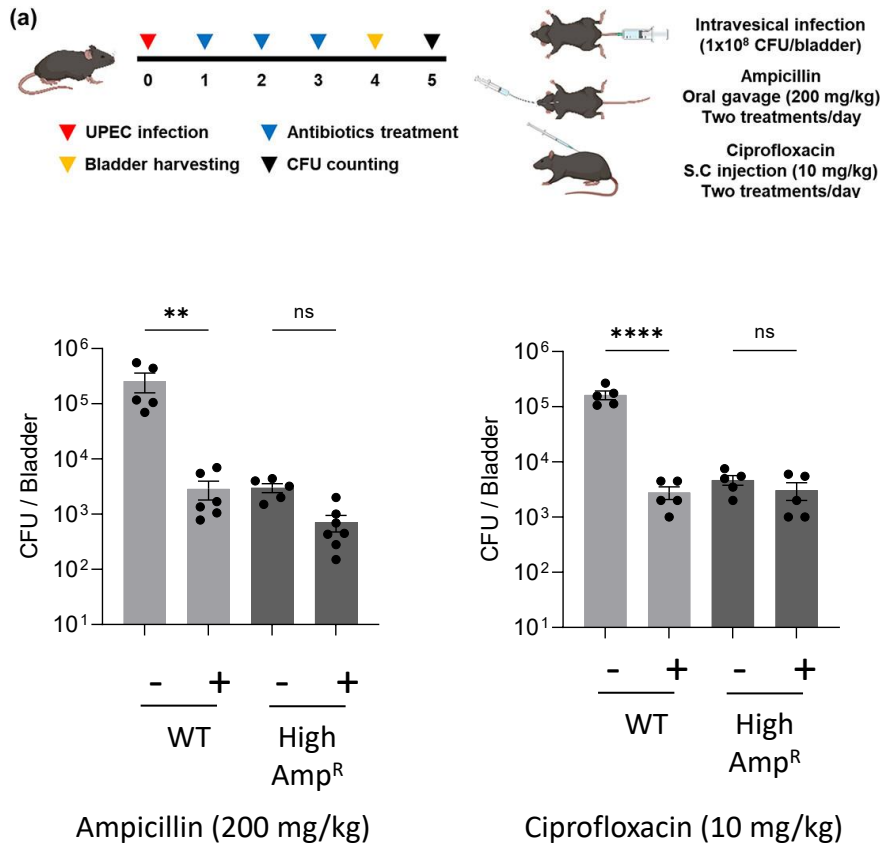
Control tissue



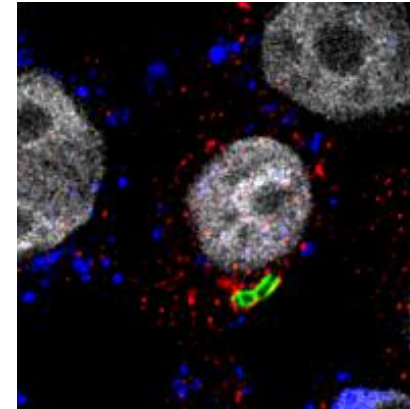
Recurrent UTI patients



High Amp^R UPEC strain maintains bacterial burden in the bladder even with antibiotics treatment

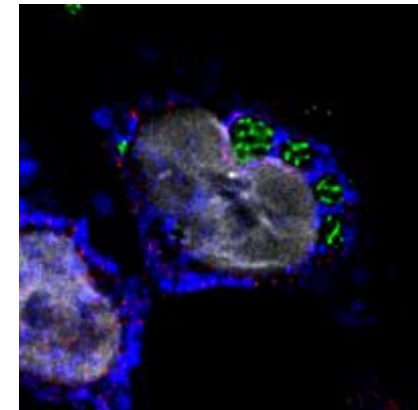


(Rab27⁺ vesicles)

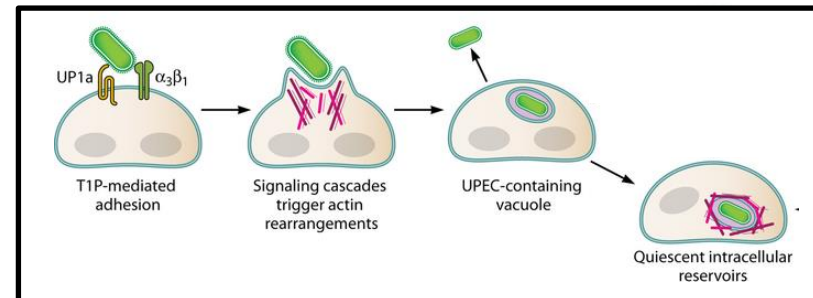


RAB27b / UPEC / LAMP1 / Nucleus

(Lamp1⁺ vesicles)



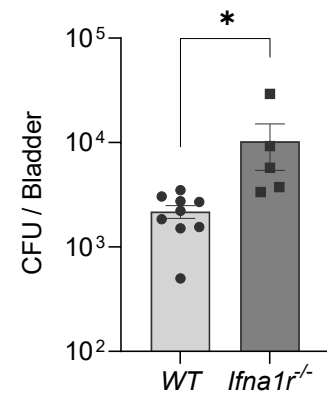
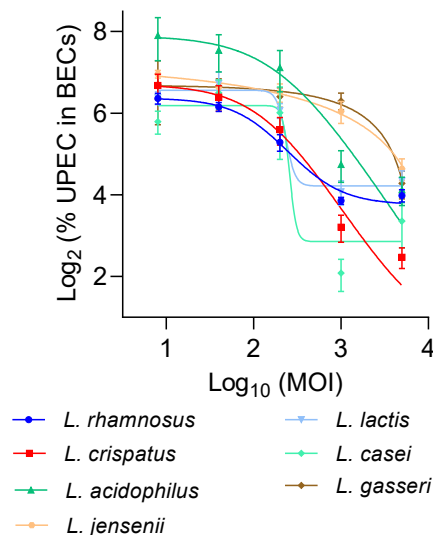
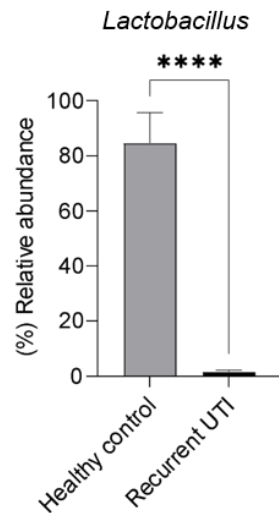
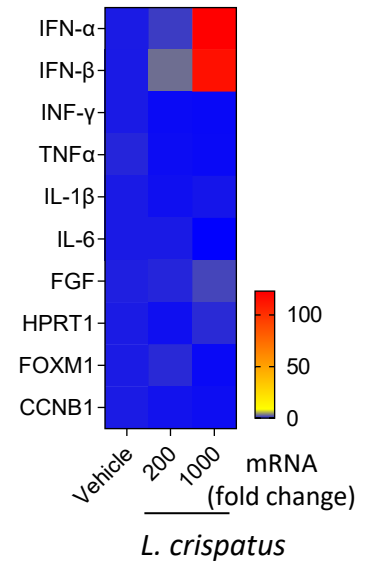
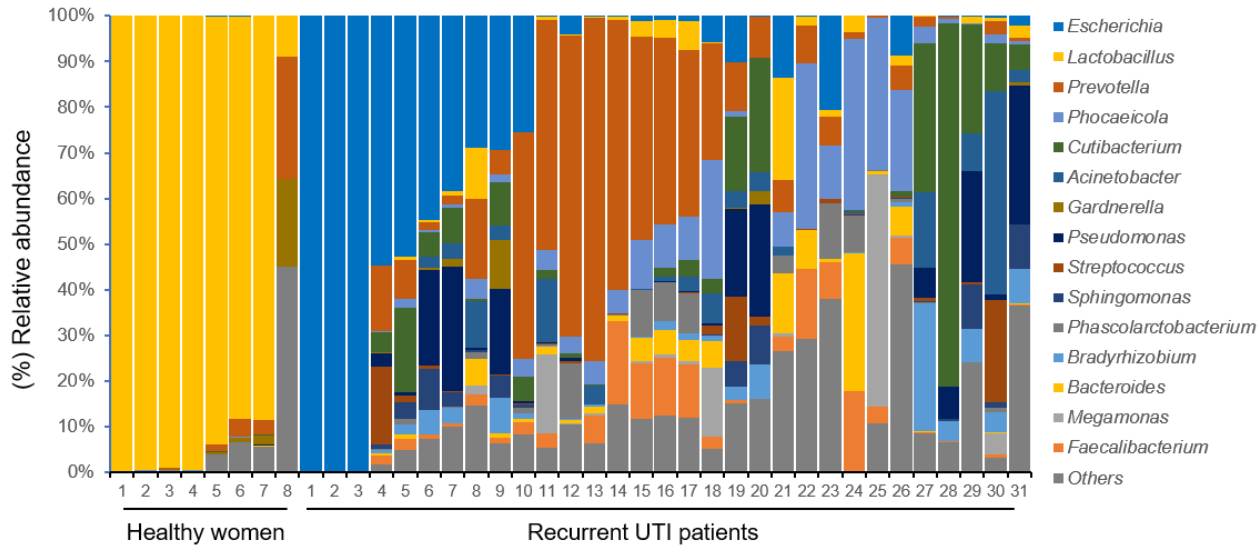
RAB27b / UPEC / LAMP1 / Nucleus



Alternative approaches for therapeutic purpose to treat antibiotics resistance UTI

- Utilization of commensal microbes**

Utilization of *Lactobacillus* to protect host epithelium against UPEC infection

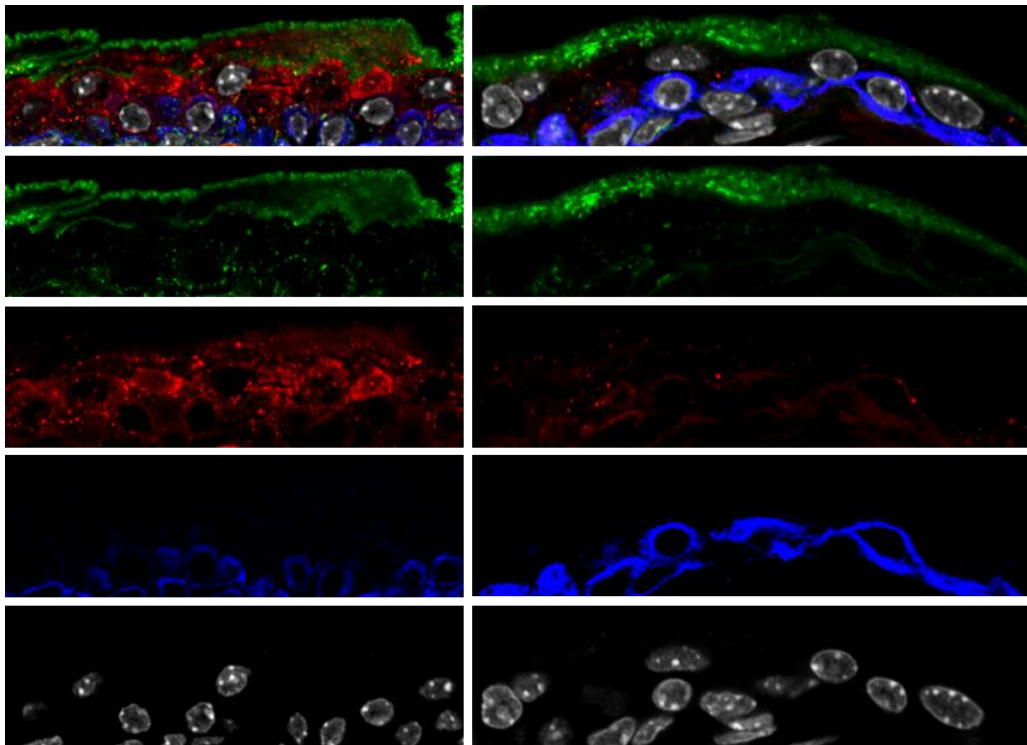


Song CH et.al. (PNAS 2022)

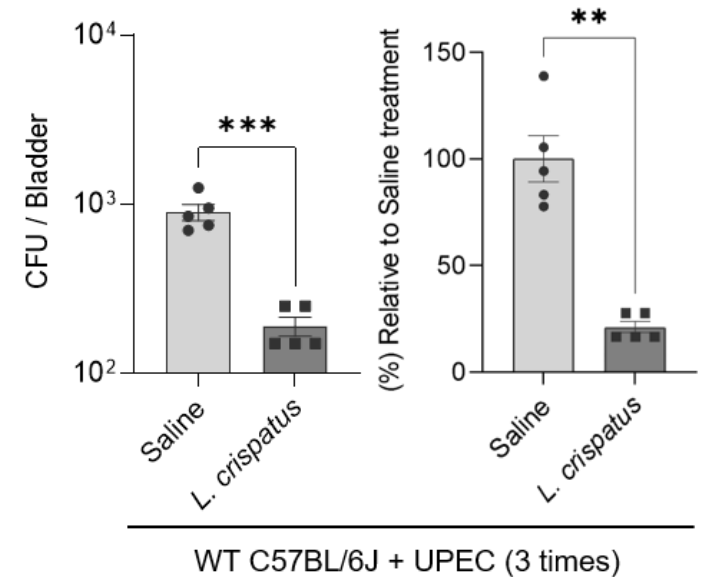
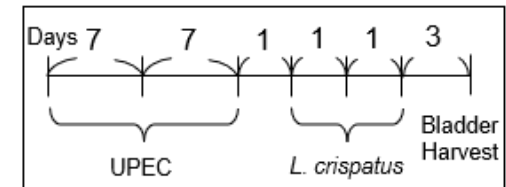
Lactobacillus effectively decreased bacterial burden in mouse bladder through cathepsin D of bladder epithelium

Specific Pathogen Free

Germ Free



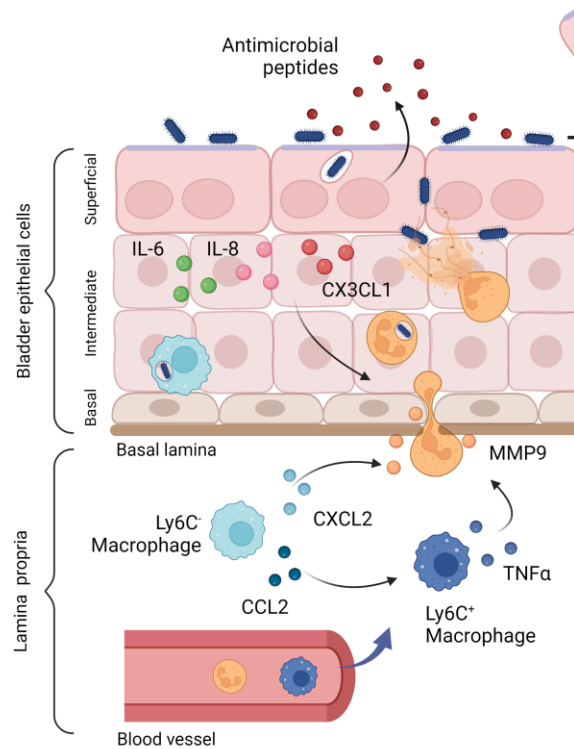
Superficial cells / Cathepsin D / Basal cells / Nucleus



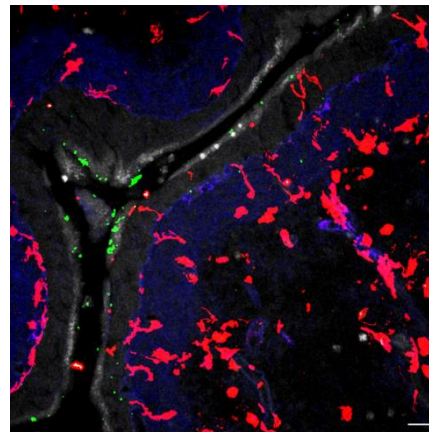
Alternative approaches for therapeutic purpose to treat antibiotics resistance UTI

- Utilization of immune modulator**

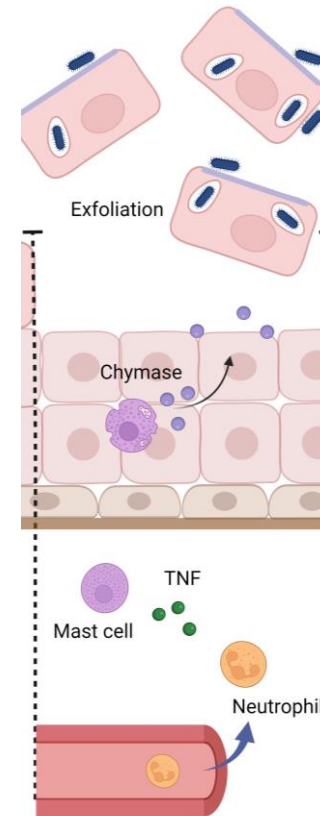
Host protective immune response against UPEC



Phagocytes uptakes extracellular pathogens

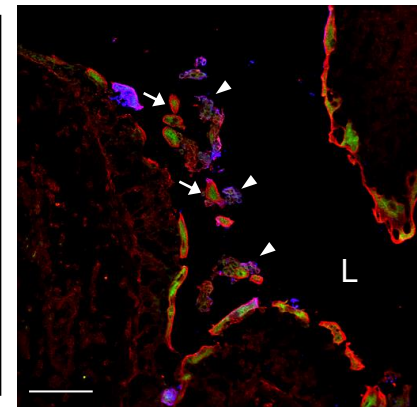


Naskar, M & Choi, HW (Immune Network 2024)



E.coli 6h p.i.

Mast cell granules + UPEC

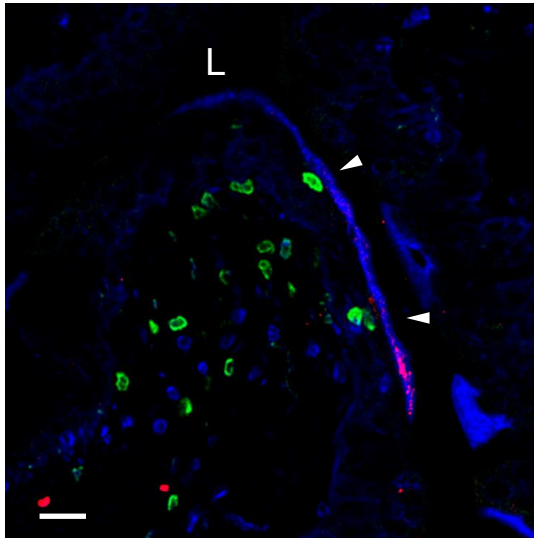


Superficial epithelial layers / Granules / *E.coli*

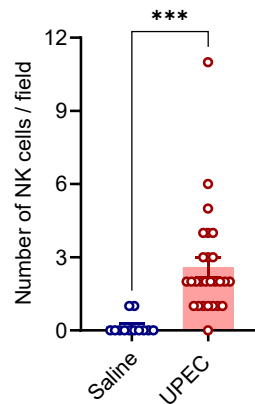
Choi, HW et. al (Immunity 2016)

NK cell recruited towards superficial epithelium of bladder during UTI

UPEC + Antibiotics (Abx)

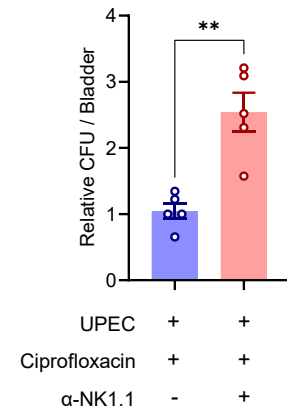
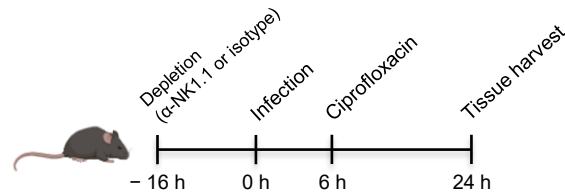
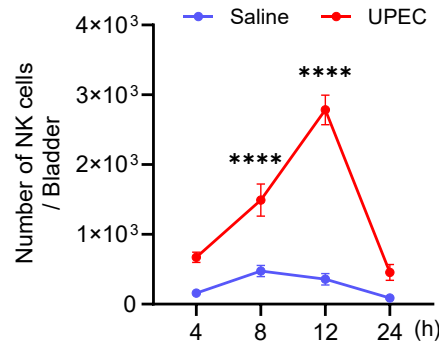
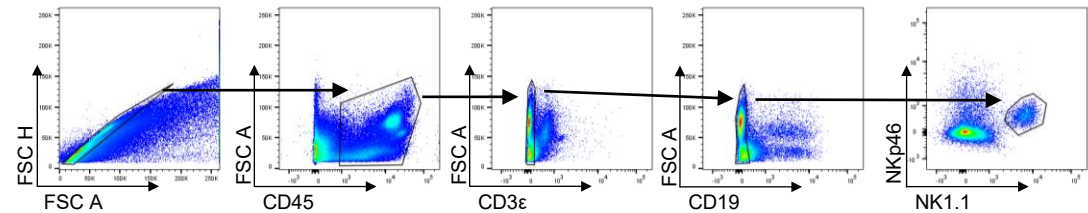


NK cells / Superficial epithelium / UPEC

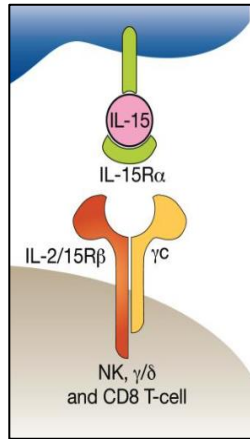


Abx

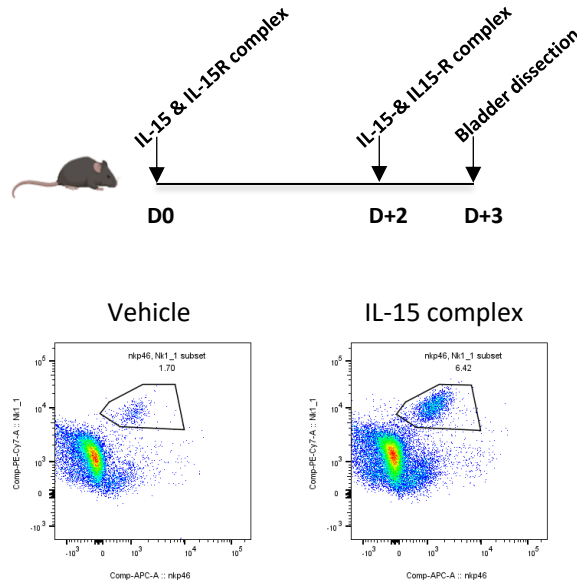
Gating strategy of 12 hours post infection



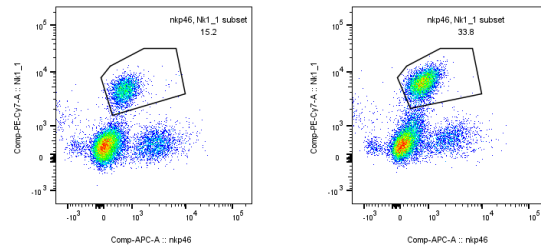
Reduced bacterial burden in vivo post IL-15:IL-15R complex treatment



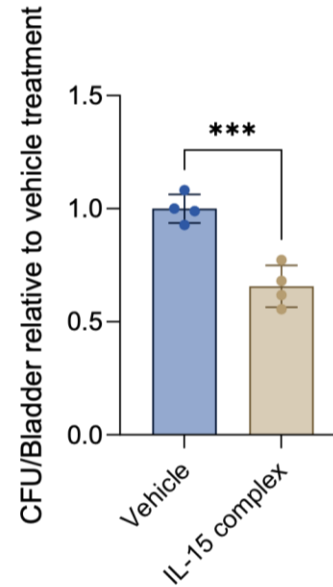
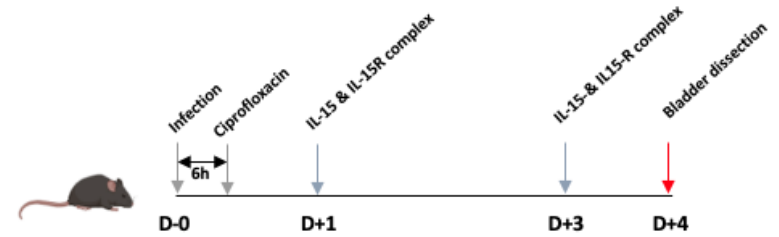
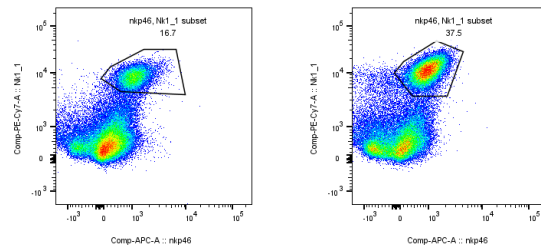
Bladder



Blood



Spleen



Alternative approaches for therapeutic purpose to treat antibiotics resistance UTI

- Phage Therapy**

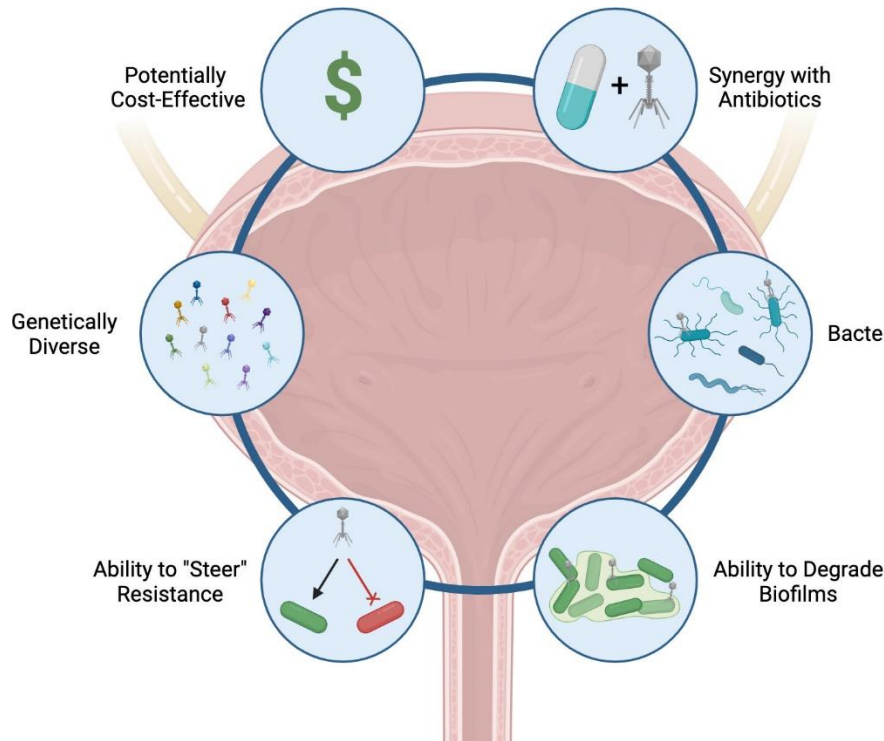
Phage Therapy for Urinary Tract Infections (UTIs)

- **Bacteriophage (Phage): Virus infecting bacteria**
 - 1 of 7 key strategies against **AMR crisis** (NIAID)
 - Phage-Derived Antibacterial Proteins
 - Endolysins: Degrade peptidoglycan (PG); break bacterial cell wall
 - Depolymerases: Destroying outer membrane polysaccharides biofilms and enhancing antibiotic sensitivity
- Advantages of Phage Therapy
 - **High specificity, low toxicity**
 - Self-replicating at infection site
 - Biocompatible (oral, topical, etc.)
 - Effective against biofilms



MattL_Images/Shutterstock.com

Phage Therapy for Urinary Tract Infections (UTIs)



- Intravesical Phage Therapy for UTI
 - Monophage or phage cocktail
 - Direct bladder instillation via catheter
 - Enables high local phage concentration (2×10^7 PFU every 12 h)

- Phage–Antibiotic Synergy (PAS)
 - Combination enhances biofilm clearance (Meropenem + Phage)
 - Helps suppress resistance

Research Team

You-Hee Cho, Ph.D.

- Experimental phage therapy & Antiphage defense
- Phage-inspired antibacterials & Antipathogenic discovery
- Bacterial virulence mechanisms

Major Publication

AAC (2009; 2012), PNAS (2014), J Virol (2021; 2025),
iScience (2024), FEMS Microb Rev (2025)

J Med Microbiol (2021), Virulence (2021; 2022)

Antioxid Redox Signal (2021), Virulence (2022),
mSystems (2024)

Eun-Jin Lee, Ph.D.

- Macrophage-pathogen interaction
- Differential regulation of virulence gene
- Lab-evolution of antibiotic resistance in pathogenic bacteria

Major Publication

Cell (2013) Nat Commun (2019), NAR (2025)

Nature (2012), PNAS (2014) Mol Micro (2017)

Virulence (2024)

Hae Woong Choi, Ph.D.

- Mechanisms of UTI pathogenesis and host-commensal microbial interplay
- Innate immune recognition and response to pathogenic microbes
- Mechanism of hypersensitivity and its therapeutics

Major Publication

Virulence (2024), PLoS Pathog (2023),
PNAS (2022), Immunity (2016)

JBC (2022), SLAS Discov (2019),
Immunity (2013)

Pharmacol Res (2023), Science (2018)

**Thank you for your
attention!**