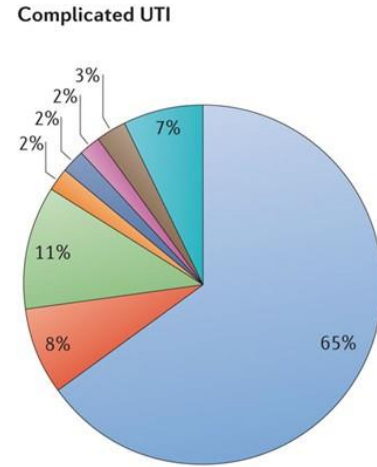
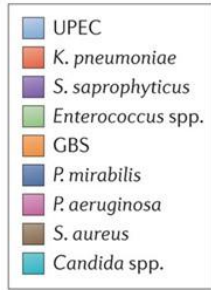
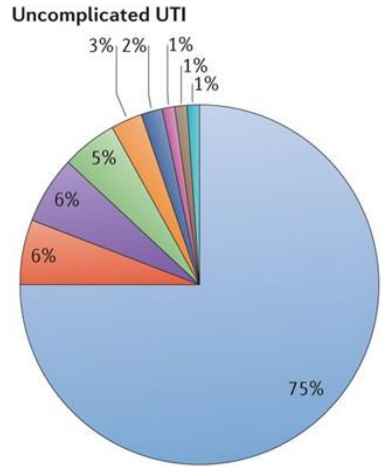




# Dual-functional antimicrobial paint to combat catheter-associated urinary tract infections

Dipanjana Patra & Prof. Jayanta Haldar\*, Antimicrobial Research Laboratory, JNCASR

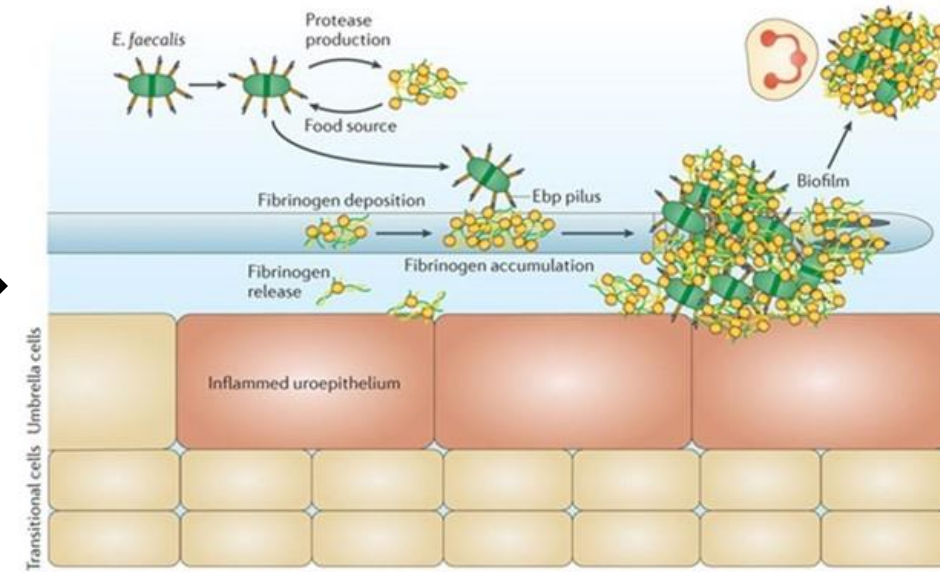
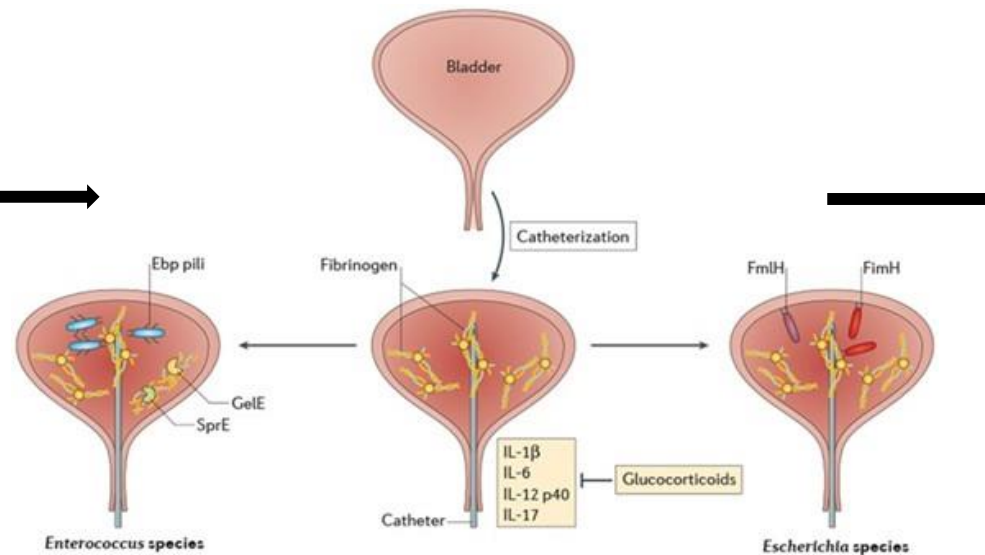
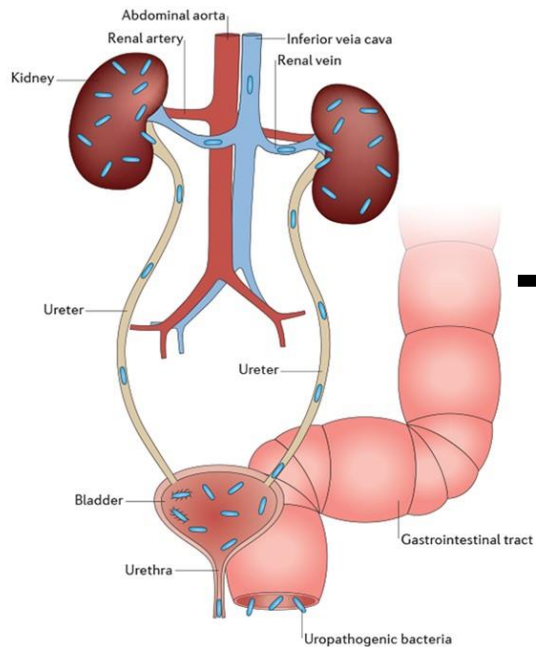


- Risk factors**
- Indwelling catheters
  - Immunosuppression
  - Urinary tract abnormalities
  - Antibiotic exposure

- Risk factors**
- Female gender
  - Older age
  - Younger age

- ❖ Almost **25%** of hospitalized patients have catheters implanted
- ❖ **>75%** of nosocomial infections are related to catheter associated urinary tract infections (CAUTIs)
- ❖ Common catheter materials are **silicone, polyurethane, latex rubber**

## Problems encountered during catheterization

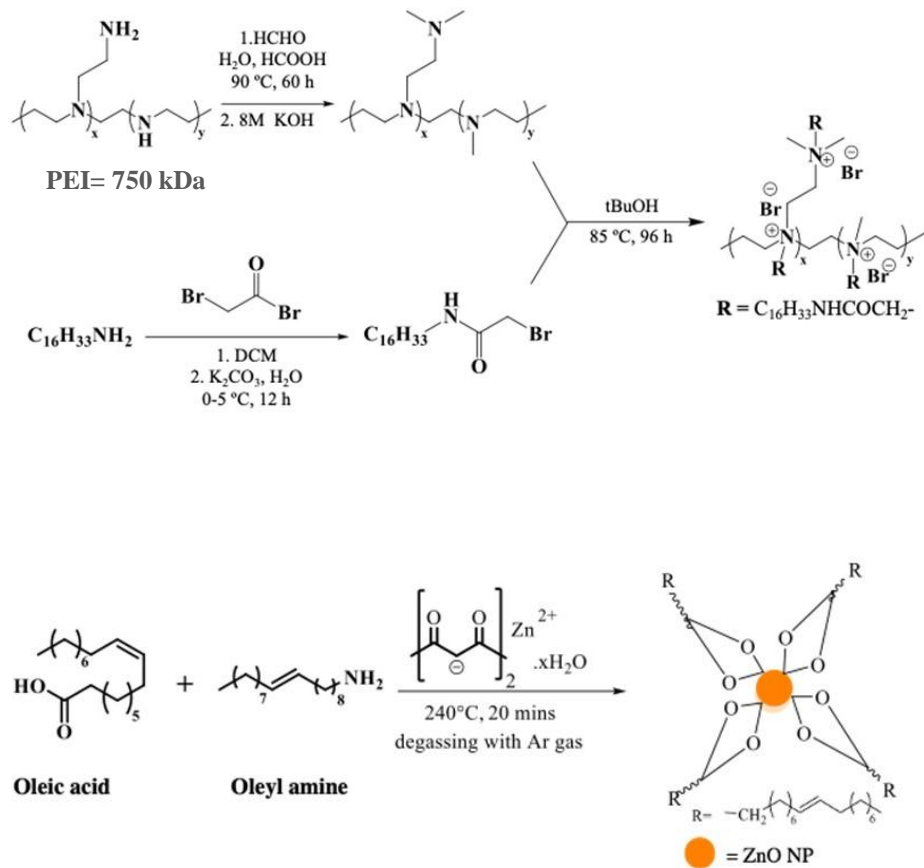


Klein et al., Nat Rev Microbiol. 18, 2020, 211-226

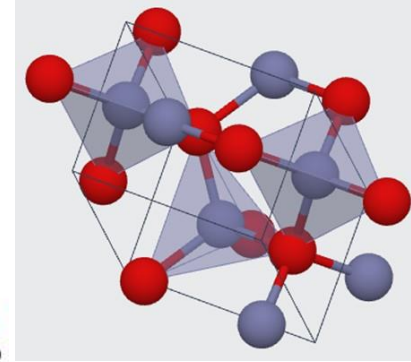
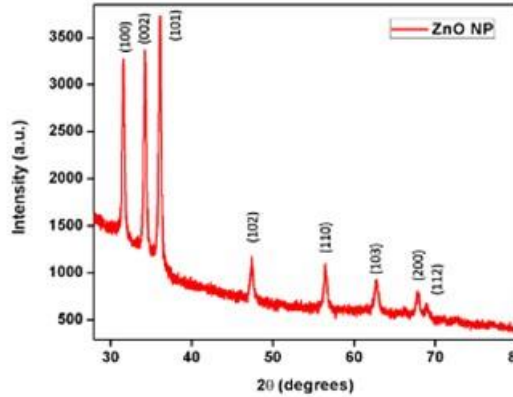
Hultgren et al., Nat Rev Microbiol. 13, 2015, 269-284

# Designing polymer-nanocomposites to tackle CAUTI

## Design rationale and synthesis

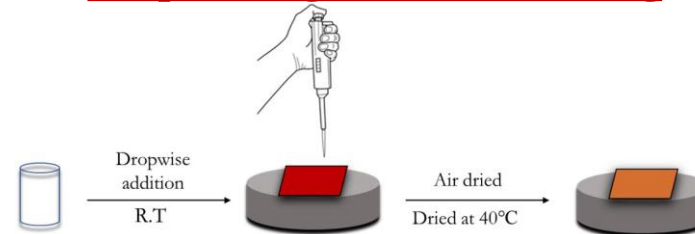


## Characterization of ZnO nanoparticle



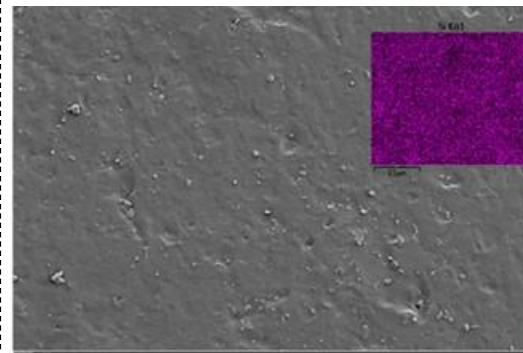
❖ The nanoparticles obtained were of hexagonal crystal structure

## Drop-casting method of coating

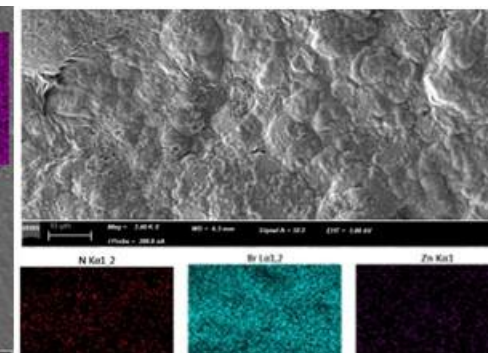


## SEM

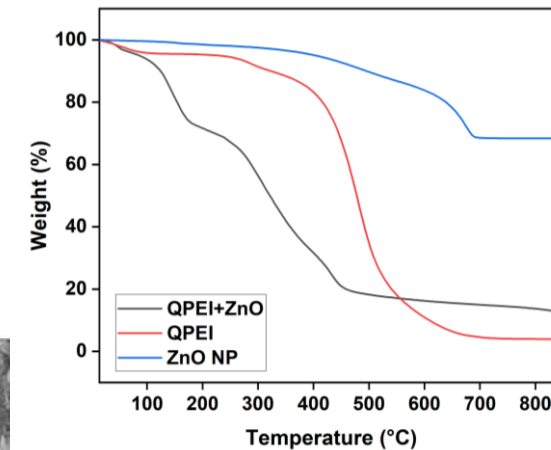
### Uncoated surface



### Polymer-ZnO coated surface



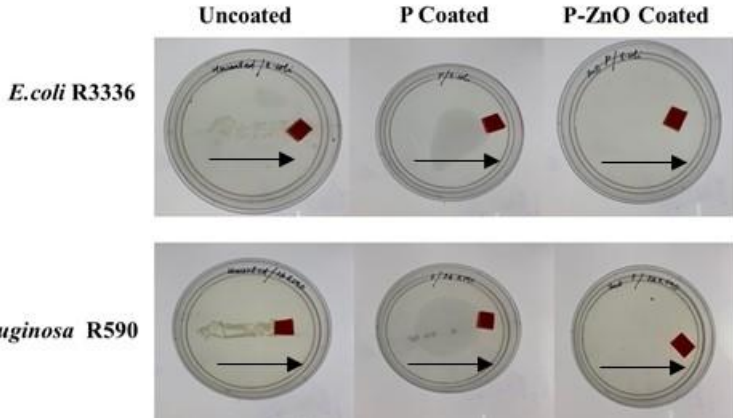
## Thermal stability of the coating



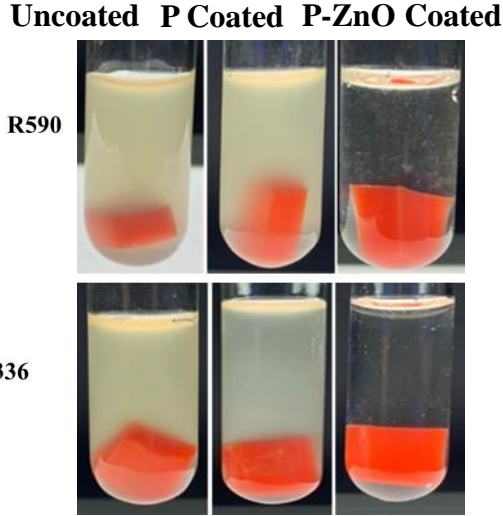
❖ Surface morphology of surface determined through SEM

# Antibacterial activity against uropathogenic bugs

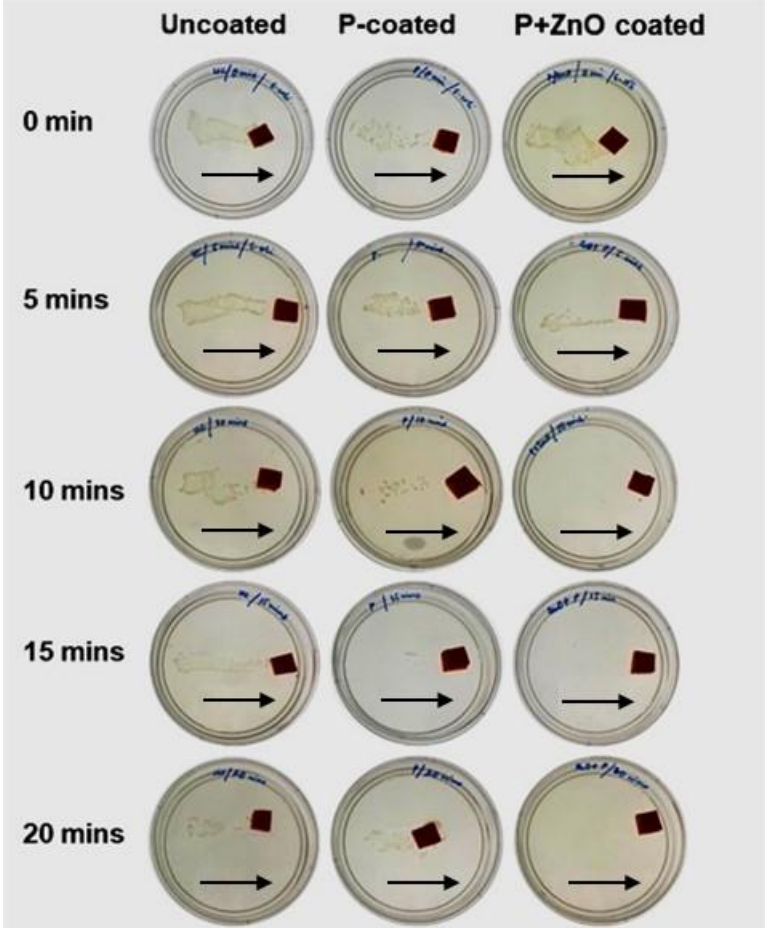
## Antibacterial activity



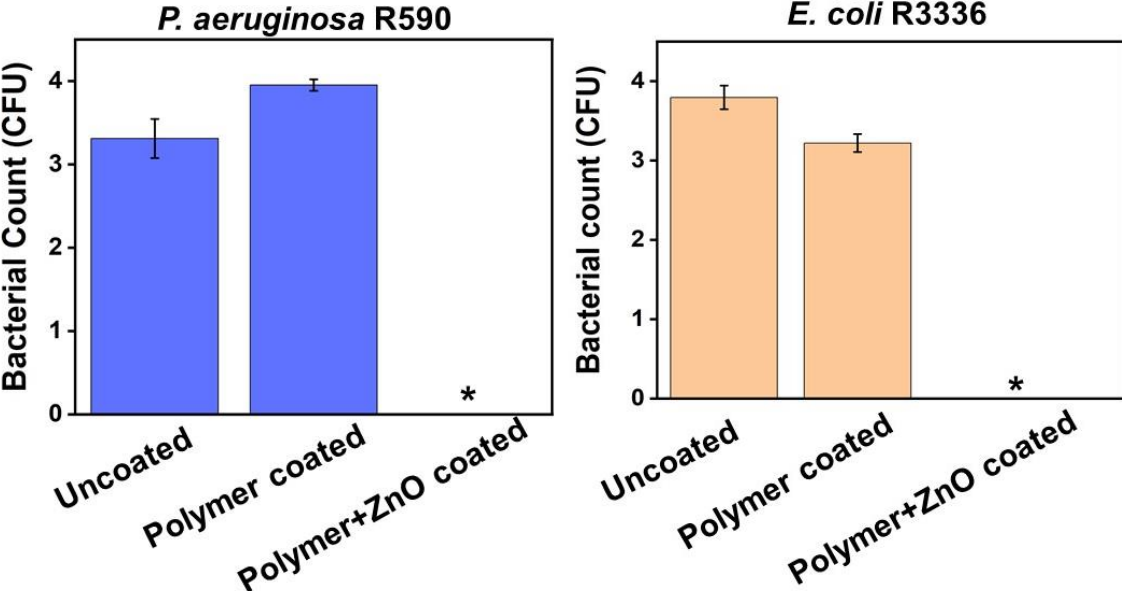
## Turbidity test



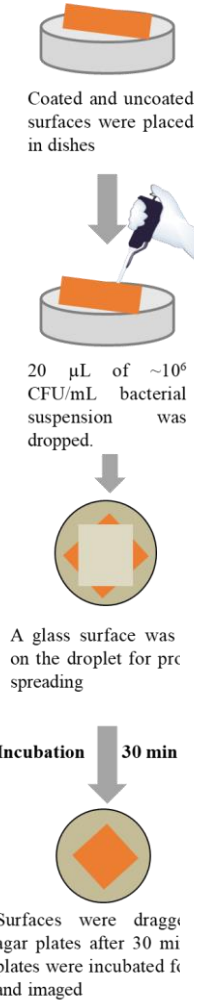
## Time-kill kinetics against *E. coli* R3336



## Bacterial reduction



❖ There was ~3.5 log reduction in *P.aeruginosa* R590 bacterial count for P+ZnO and ~4 log reduction in *E. coli* bacterial count



# Antifungal experiments

## Time-kill antifungal activity

*C. albicans* AB226

*C. albicans* AB399

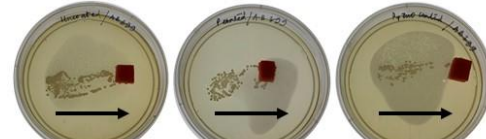
Uncoated P Coated P-ZnO Coated

Uncoated P Coated P-ZnO Coated

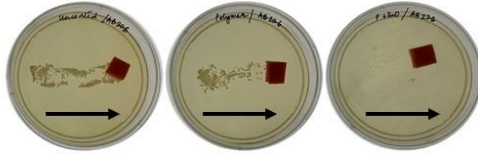
30 mins



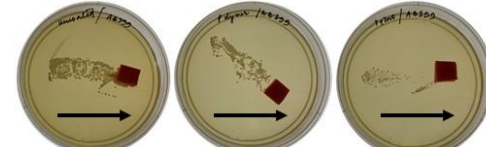
30 mins



60 mins



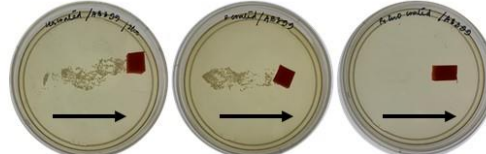
60 mins



120 mins

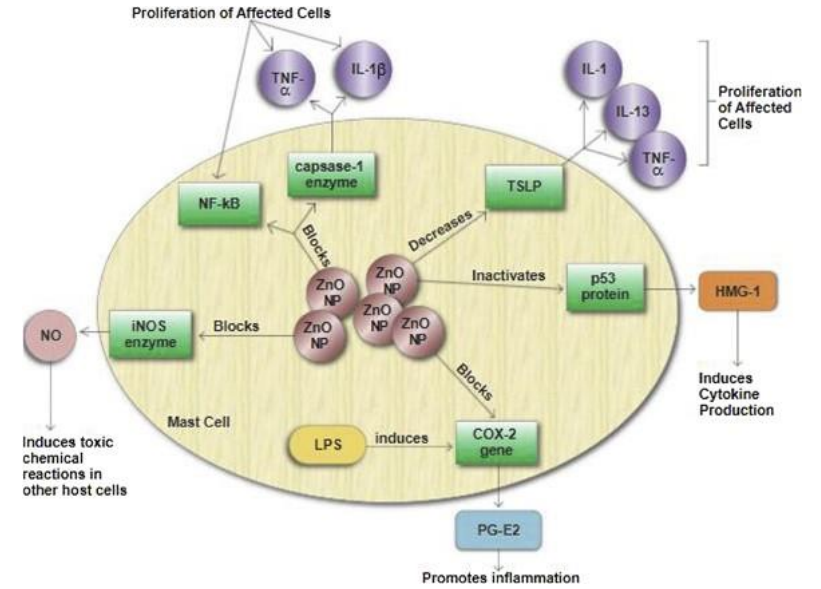


120 mins



## Future aspects

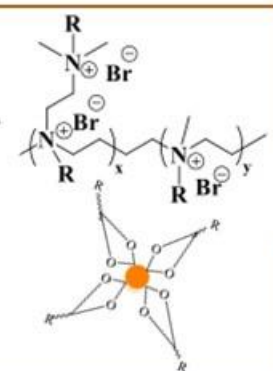
### Anti-inflammatory mechanism adopted by ZnO NP



Agarwal et al., *Biomedicine & Pharmacotherapy*. 109, 2019, 2561-2572

## Conclusion

❖ Thermally stable polymer-nanocomposite was synthesised in a few simple steps



❖ Polymer nanocomposite killed bacteria in 10 mins and showed antifungal activity in 2 hours

## Acknowledgement

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