




CAIRIBU UROBIOME RESEARCH INTEREST GROUP (U-RIG)

CAIRIBU U-RIG RESEARCH HOURS


EXECUTIVE SUMMARY 9/15/2023 U-RIG RESEARCH HOUR

Goal: Facilitate knowledge exchange and spur collaborations in the urobiome and adjacent fields




CAIRIBU U-RIG RESEARCH HOUR

BRIDGING KNOWLEDGE GAPS IN THE UROBIOME



FRIDAY, SEP 15
3:00 PM ET
2 PM CENTRAL | 12 PM PACIFIC

SPEAKERS



Lindsey Burnett, MD, PhD
Urogynecologist
Assistant Professor of Obstetrics, Gynecology, and Reproductive Sciences
University of California - San Diego
Understanding the Role of Host Cell Metabolism in Urinary Tract Infection



Aaron Miller, PhD
Principal Investigator
Lerner Research Institute
Cleveland Clinic
The presence of bacteria right where you expect them: Implications of kidney bacteria for urologic pathologies

NOTES FROM PRESENTATIONS OF DRs. BURNETT AND MILLER AND SUBSEQUENT DISCUSSION

Evidence of Bacteria in Kidneys

- Dr. Aaron Miller reviewed **historical evidence dating back to 1767, from studies on kidney stones and cultures, that supported the presence of bacteria in the kidneys**
- Recent research reveals bacteria in both infection and non-infection stones, even in patients without urinary tract infection history
- The kidney's role in filtering bacteria from the bloodstream was discussed, emphasizing its protective function
- Active bacterial metabolism within kidney stones was found in a 2018 study, suggesting bacteria may reside in the kidneys at sub-infectious levels

Impact on Renal Physiology

- Dr. Aaron Miller and his team have detected bacteria in kidney tissues with RNA-based techniques and have found higher levels in autopsy tissues
- **Transcriptomic analysis demonstrated differences between glomeruli and tubules**
- An increase in microorganisms over time suggests infiltration into the kidney space

Relationship with Kidney Disease and Stones

- Kidney microbiome diversity increases with kidney function decline and is associated with various kidney diseases
- Antibiotics, intended to decrease pathogens, actually increase certain pathogenic bacteria, exacerbating kidney disease
- A mouse model study highlighted the differential impact of antibiotics on bacteria
- Bioreactor models are used to study bacterial roles in kidney stone formation



Impact on Kidney Stone Growth

- *E. coli* and Lactobacillus strains directly influence calcium oxalate crystal growth and aggregation
- **Antibiotics shift the balance towards uropathogens**, worsening kidney disease

Host Cell Metabolism in UTIs

- Dr. Lindsey Burnett discussed the role of host cell metabolism in urinary tract infections (UTIs)
- She further emphasized the impact of pelvic floor muscle stretching during vaginal delivery on metabolism, mitochondrial function, and oxidative capacity
- Obesity predisposes women to pelvic floor disorders and recurrent UTIs

UTI Treatment and Prevention

- **Current UTI definitions and culture standards need updating to consider the urinary microbiome**
- Symptoms in recurrent UTIs are correlated with bacteria, emphasizing host factors.
- Bacterial infection alters mitochondrial metabolism in urothelial cells, increasing susceptibility to recurrence
- Vaginal estrogen cream reduces UTI recurrence in postmenopausal women

Gut Bacteria in Kidney Stone Formation

- Host metabolism, including mitochondria, plays a role in bacterial persistence and clearance
- Antibiotics or other triggers can activate kidney bacteria, leading to biofilm formation and stone formation

Impact of Antibiotics on Bacterial Diversity

- **Antibiotic exposure increases bacterial diversity in kidneys** (i.e., of pathogenic bacteria), highlighting potential consequences for the microbiome
- Caution is advised against antibiotic overuse

Mouse Models for UTIs

- **Diversity in urinary tract bacteria may not always indicate health**
- Mouse models are used to study UTIs and validate in vitro findings; limitations of mice as models noted

Dog (Companion) Models for Urinary Microbiome Research

- Research on aging and metabolic changes in bladder tissue with obese and diabetic animals
- Similarities found between human and dog urinary microbiomes despite diet and lifestyle differences
- Dogs and humans in the same households share UTI pathogens, making dogs good models for research

Microbiome Research in Dogs and Cats

- Researchers work with companion animals to identify nutritional and other treatments
- Focus on nutrition and dietary supplements to alter the urinary and gut microbiomes
- The potential link between pets and UTIs was discussed, with a mention of recent relevant research

ADDITIONAL RESOURCES

- Helmholz, HF. (1925). *The Kidney: A Filter for Bacteria*. The Journal of the American Medical Association.
[LINK AVAILABLE ON THE CAIRIBU WEBSITE U-RIG PAGE under "CAIRIBU Research Interest Groups"](#)