Assessment of environmental and occupational exposure while working with *Mycobacterium abscessus* in mouse models

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Why *Mycobacterium abscessus*?

- *Mycobacterium abscessus* (Mabs) is a rapidly growing nontuberculous mycobacterium that is responsible for:
  - respiratory infections
  - healthcare-associated extrapulmonary infections

- It is hard to treat because of its resistance to current antibiotic therapies

[https://www.buzzrx.com/blog/copd-vs-ipf-idiopathic-pulmonary-fibrosis](https://www.buzzrx.com/blog/copd-vs-ipf-idiopathic-pulmonary-fibrosis)
Why Assess Exposure?

**Novel experimental design**
- High concentrations of inoculum
- Aerosol exposure equipment

**Animal research**
- Risk for immunocompromised staff
- Risk of bites and aerosolization
- Risk from animal housing and handling
Methods of Infection

1. Tail-vein Injection
   - Six C3HeB/FeJ mice
   - Oral dexamethasone treatment at 20 mg/L
   - 6 log10 CFU injected into the tail vein
   - 7H9-OADC Middlebrook broth

2. Inhalation Exposure Chamber
   - Sixteen C3HeB/FeJ mice
   - Oral dexamethasone treatment at 4 mg/L
   - 3-3.5 log10 CFU per lung
   - 7H10-OADC plates
Tail-Vein Injection Shedding Study

- Sample sites:
  - **Mouse:** Oral, anal, urine, feces
  - **Environmental:** Settling plates in BSC during euthanasia and necropsy
- Time Point: 7 days post infection (study completion)
### Tail-Vein Injection Results

<table>
<thead>
<tr>
<th>Individual</th>
<th>Oral</th>
<th>Anal</th>
<th>Urine</th>
<th>Feces</th>
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<td>♂ #1</td>
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+= mycobacterial growth

Environmental plates were all negative
Fluorescent Microscopy of Shedding Samples

Confirmation of mCherry in all positive samples
Inhalation Exposure

• Sample sites:
  – Mouse: fur, oral, anal, and urine
  – Environmental: “hot spots,” settling plates

• Time points: Baseline, Day 1, Weeks 1, 3, 5, and 7
  – Additional if symptoms present

https://www.researchgate.net/figure/whole-body-inhalation-exposure-system-Notes-The-Glas-Col-R-aerosol-exposure-chamber_fig2_280104120
Glas-Col Inhalation Exposure System

- Preheat
- Nebulization
- Cloud Decay
- Decon.
- Cool Down
Inhalation Exposure Results

• Exposure risk from:
  – Whole body aerosol exposure
    • Baseline – *no growth*
    • Day 1 – *no growth*
  – Shedding from infected mice
    • Weeks 1, 3, 5, and 7 – *no growth*

Mouse lung infection
Takeaways

• Exposure risks can vary according to route of administration
• Different methodologies can be used to conduct evidence-based risk assessments at other institutions
• Evaluate engineering controls prior to working with higher risk organism
• Results helped confirm our internal risk assessment
The Evidence-Based Biosafety Roadmap

• Call for evidence-based biosafety
• Opportunity for fellowship training programs like NBBTP and APHL to support these projects
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Thank you!

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