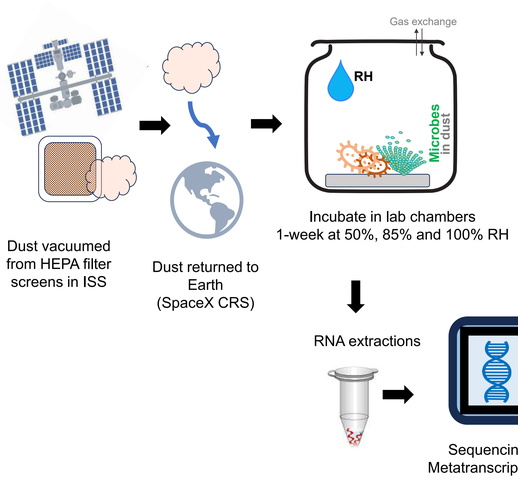
Moisture Matters: Fungal function is influenced by RH in ISS dust

Neeraja Balasubrahmaniam, Nicholas Nastasi, Bridget Hegarty, John M. Horack, Marit E. Meyer, Sarah Haines, Karen C. Dannemiller

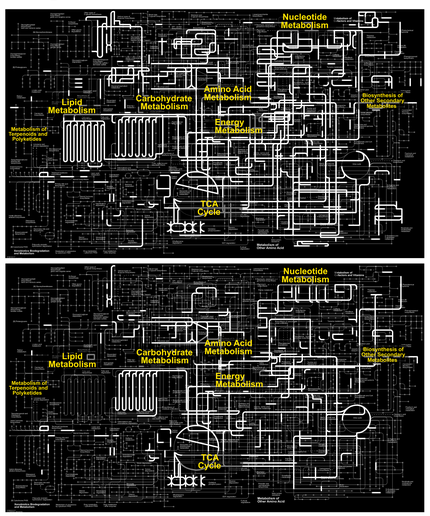
Background

- Mold in homes is linked to asthma and costs $22.4 billion per year in the US.
- In the International Space Station (ISS), unforeseen system failures can result in moisture related growth.
- Fungal compositions change with moisture in ISS dust.
- We do not know how fungal function changes during growth at elevated Relative Humidity (RH).

Goal: Understand function during fungal growth in spacecraft at elevated RH



Metabolic pathways were more expressed at elevated moisture

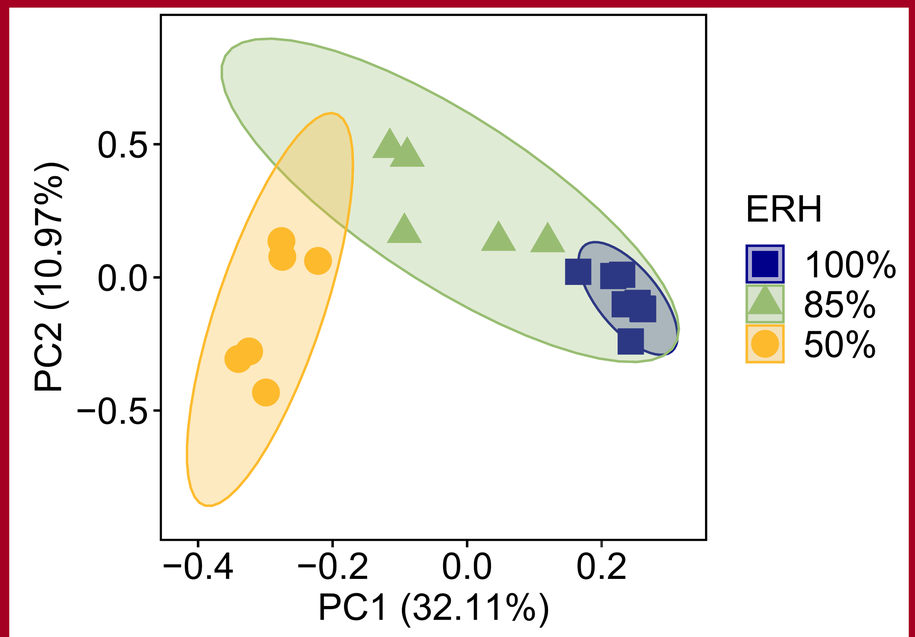


→ (a) Upregulated at 100%

→ (b) Upregulated at 50%

Metabolic pathways at 100% and 50% RH*:* KEGG pathway analysis of upregulated fungal genes shows more metabolic pathways (highlighted in white) as upregulated at elevated 100% RH compared to 50%

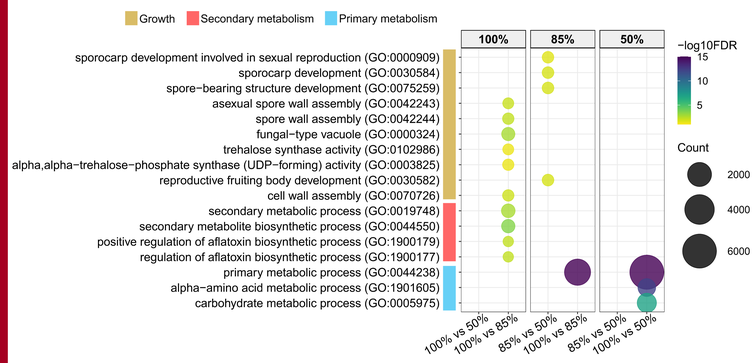
Fungal gene expression is strongly influenced by moisture in International Space Station (ISS) dust



Principal components (PCA) plot of samples colored by ERH (Equilibrium Relative Humidity: or RH) condition based on gene expression data

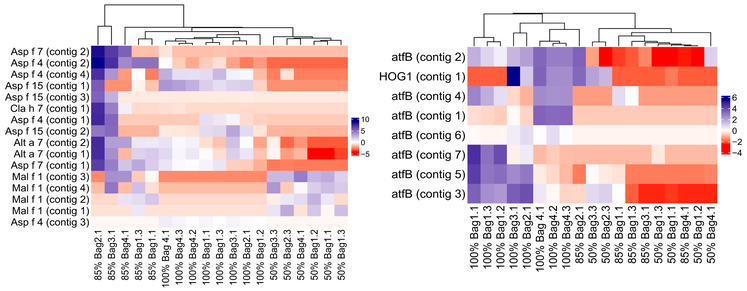
Read the full paper here!

Fungal secondary metabolism and growth functions were enriched at elevated ERH



Gene Ontology (GO) analysis revealed fungal growth, secondary and aflatoxin metabolic terms enriched at elevated RH.

Fungal allergen and aflatoxin genes upregulated at elevated RH



Differential gene expression analysis shows (a) fungal allergen and (b) aflatoxin genes upregulated at elevated RH conditions. In the heatmap: Blue represents higher expression; Red represents lower expression.

Conclusions and Future Directions

- We need more robust measures of mold growth indoors based on microbial function
- At elevated moisture we saw more allergen and mycotoxin gene expression
- Function could be used for mold detection in these specialized environments in the future

Check out the IEQ Lab at OSU!

https://ceg.osu.edu/indoor-environmental-quality-laboratory

IEQ Indoor Environmental Quality Research Group

THE OHIO STATE UNIVERSITY