LIGHTNING TALK:

David Firer

Between cellulose and chitin, the unique architecture of the chytrid cell wall

David. Firer[1,2], Donald C. Sheppard[1,2], François Le Mauff[1,2]

[1]Department of Microbiology and Immunology, McGill University, Montreal, QC, Canada
[2]Infectious Diseases and Immunity in Global Health Program, Research Institute of the McGill University Health Center, Montreal, QC, Canada

Background: Worldwide spread of the aquatic chytrid fungi *Batrachochytrium dendrobatidis* (*Bd*) and *Batrachochytrium salamandrivorans* (*Bsal*) has threatened the extinction of up to 40% of amphibian species. This lethal fungal infection begins when motile chytrid zoospores adhere to amphibian skin where they mature into sessile zoosporangia that disrupt amphibian epithelium integrity, leading to electrolyte loss and death. Mature zoosporangia then release a new generation of zoospores to restart the cycle of infection. Interfering with zoospore adhesion and/or release is therefore a promising strategy to prevent the spread of chytrids.

Hypothesis: Fungi are known to use a diverse and dynamic network of cell wall polysaccharides to mediate adhesion and reproduction. We therefore hypothesized that chytrid cell wall polysaccharides may play a key role in the virulence of these pathogens.

Methods: Identification of *Bd* and *Bsal* cell wall polysaccharides was performed using gas chromatography/mass spectrometry (GC-MS) and MALDI-TOF mass spectrometry. The presence and localization of the specific glycan motifs were confirmed using immunofluorescence confocal microscopy, and the effects of inhibiting specific glycan synthesis or enzymatic degradation were examined.

Results: The cell walls of both *Bd* and *Bsal* were found to predominantly contain glucose, *N*-acetylglucosamine (GlcNAc), and mannose, with trace quantities of xylose, galactose, and *O*-methylglucose. Monosaccharide linkage analysis and oligosaccharide structure elucidation by MALDI-TOF MS revealed the prevalence of cellulose and chitin as well as a polymer of 4-linked mannose, and 4-linked xylose. Confocal microscopy further confirmed the presence of this unusual combination of polymers within the chytrid cell wall and revealed unique distribution patterns of individual polysaccharides in specific organisms. Treatment with chitinase and the chitin synthase inhibitor, Nikkomycin Z, resulted in irregular zoosporangium development and GlcNAc staining patterns, suggesting an important role for chitin/chitosan in fungal development.

Conclusion: This study constitutes the first demonstration of a fungal cell wall composed of cellulose and chitin, two of the strongest structural polysaccharides that exist. Further work describing the role of this exclusive cell wall composition and its synthesis is presently on-going, ultimately aiming to discover potential targets for the development of novel therapeutics.