

Applied and Environmental Mycology Laboratory

Project title: Defeating the human pathogen *Aspergillus fumigatus* in indoor environments through the use of tailored ionic liquids

Area: Environmental science and Technology

Supervisors: Dr Cristina Silva Pereira and Dr Marija Petkovic

Duration: 9-12 months

Background

Dampness is affecting 20-30% of the residences in Europe and favouring growth of numerous fungal strains. Fungal contamination causes immense economic losses and importantly, it presents a major health risk related with various respiratory symptoms, allergy and asthma. *Aspergillus fumigatus* is a well-known invasive and opportunistic human pathogen and ubiquitous in indoor settings. It usually grows in a form of a biofilm with significantly higher resistance to antifungal agents.

Ionic liquids are functionalised organic salts which are, in general, liquid below 100°C. Their potential is set in the fact that their physical, chemical and antimicrobial properties may be tuned by fine structural alterations of the cation and the anion. Our team has an excellent track-record in both ionic liquids toxicity towards filamentous fungi and the dissolution of complex natural polymers. Recently we have observed that ionic liquids trigger alternative cell wall integrity pathway in *A. nidulans*, encouraging us further in the quest for their novel molecular targets.

Objectives

The main goal of the proposed project is to reduce the negative health impact of *A. fumigatus* biofilm using task-designed ionic liquids. Several strategies will be undertaken:

- (i) dissolution of the extracellular polymeric matrix and strong inhibition of fungal growth
- (ii) interference with specific metabolic pathways responsive during biofilm growth, e.g. biosynthesis of the fungal cell wall and extracellular polymeric matrix components, gliotoxin production
- (iii) reduction of the allergenic potential by interfering with key genes involved in allergenic polypeptide biosynthesis pathways

Project description

Proposed research plan relays on multidisciplinary approach and the student will have an opportunity to gain skills in organic chemistry, biochemistry, mycology and molecular biology. Besides standard microbiology techniques, e.g. cultivation of fungal strains (wild-type and mutant strains), susceptibility and biodegradability assays, student will perform cytotoxicity assays and polysaccharide analysis. The core of this project relies on molecular biology techniques (gene expression analyses by qRT-PCR) and immunoproteome analysis.

The student will be supervised by the PI of Applied and Environmental Mycology Laboratory Dr Cristina Silva Pereira and co-supervised by Dr Marija Petkovic who is directly involved in this project. Several collaborators, iBET, QUILL (UK), Proteomics Platform, Centre de Recherche Public Gabriel Lippmann (Luxembourg) are also involved in this project.

