Investigation of chitin and chitosan forms as value-added materials derived from mycelia of *Fusarium venenatum*

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Usage of microbial protein for food production can be one of the promising solutions for the current high demand of sustainable non-animal origin proteins.
Fungal cells are surrounded by a cell wall comprising polysaccharide components, namely mannoproteins, β-1,3 and β-1,4 glucans and chitin (and in some species, also its deacetylated form, chitosan). Chitosans are water-soluble aminopolysaccharides that vary in their degree and pattern of acetylation, molecular weight and biological origin. They can be processed into hydrogels, films, scaffolds, fibres, and colloidal micro/nanoparticles and nanocapsules. They are known to interact with other biomolecules such as proteins, nucleic acids, mucins, and phospholipid membranes by both electrostatic and hydrophobic interactions. Moreover, their biological functionality includes to be biodegradable, biocompatible, non-toxic, antimicrobial, mucoadhesive, and have the capacity to lower cholesterol in plasma, among others. Given this wide spectrum of properties, the applications of chitosans have grown dramatically in several sectors such as biomedicine, food, agriculture, biotechnology, nanotechnology and textiles. Presently, industrial chitosans are sourced from seafood waste including shrimp, crab and langoustine exoskeletons using chemical methods to isolate chitin and deacetylate it into chitosan. Fungal mycelium biomass offers to be a far more sustainable source of chitin/chitosan than the crustacean shell waste. However, the optimal conditions, processing and properties of the obtained biopolymers need to be investigated. Marlow Foods has been producing meat-analogue products marketed under Quorn^{TM} brand using the fungal strain of *Fusarium venenatum*. This project aims to glean understanding about the characteristics of the chitin/chitosan biopolymer forms/microstructure present on *Fusarium venenatum* across the whole stage of biomass production, remodeling events and interactions with other components, assessing how these influences the overall product structure and texture. A second aim of the project is to isolate and characterize and explore possible applications of fungal chitin/chitosan as potential novel biopolymers of food colloids structures/matrix systems.

The project will be based in the groups of Goycoolea and Ferreira and will benefit from the University of Leeds intensive research environment available from Astbury Centre for Molecular Biology, Bragg Center for Materials Research. The student will gain advanced training in the field of biopolymers, namely on fundamental, characterization and applied aspects. This will include characterization of the molar mass distribution, degree of acetylation, degree of crystallinity, gelling, micro/nanoparticles formation, antimicrobial, gene (DNA and mRNA) electrostatic self-assembly complexation. Techniques will span, multiple detection asymmetric flow field-flow fractionation (AF4) and size exclision chromatography (SEC), nuclear magnetic resonance (NMR), dynamic light scattering (DLS), multiangle-DLS (MADLS), electrophoretic light scattering (ELS), transmission electron microscopy (TEM), Leeds SAXS facility at Diamond, oscillatory rheology, cell culture and microbiology methods, among other. The student will take an active part in the collaboration with the Future Foods Research Group of Marlow Foods.