

Function and redundancy of chaplin cell surface proteins

Working in collaboration with the Department of Biology and Institute for Infectious Disease Research, McMaster University, Canada, JIC scientists in Mark Buttner's Group have been examining the chaplins, a group of proteins which help streptomycetes attach to the surface of host plants. These 'hydrophobins' are highly surface-active and are capable of dramatically reducing surface tension at the colony air-water interface.

Germinating spores in soil-dwelling streptomycetes outgrow in the aqueous environment to form a vegetative mycelium in which secondary metabolites such as antibiotics are produced. Specialised reproductive structures (aerial hyphae) are then formed, differentiating into unigenomic spores. Vegetative hyphae are hydrophilic; aerial hyphae and spores are hydrophobic.

The chaplins are a family of eight secreted proteins that are critical for raising aerial hyphae in *Streptomyces coelicolor*. They can be separated into two main groups: the long chaplins (ChpA to -C) and the short chaplins (ChpD to -H). The short chaplins can be further subdivided on the basis of their abilities to form intramolecular disulphide bonds: ChpD, -F, -G, and -H contain two Cys residues, while ChpE has none.

The team constructed a "minimal chaplin strain" containing only *chpC*, *chpE*, and *chpH*, which raised a substantial aerial mycelium. This strain was used to examine the roles of specific chaplins. Within this strain, the Cys-containing ChpH was identified as the major polymerisation unit contributing to aerial hyphal formation and assembly of an intricate rodlet ultrastructure on the aerial surfaces, and the two Cys residues were determined to be critical for its function. The long chaplin, ChpC, augmented aerial hyphal formation and rodlet assembly, most likely by anchoring the short chaplins to the cell surface, whilst ChpE was essential for the viability of wild-type *S. coelicolor*.

Interestingly, the lethal effects of a *chpE* null mutation could be suppressed by the loss of the other chaplins, the inactivation of the twin arginine translocation (Tat) secretion pathway, or the loss of the rodlines (another group of hydrophobins).

A technical Tour de Force - Kim Findlay's beautiful, high-resolution SEM images of the chaplins surface ultrastructure, false-coloured blue, was chosen as a front cover image for the Journal of Bacteriology (scale - 1 pair of rodlets is 20 nm across)