



# Comprehensive characterization of Cysteine-rich protein-coding genes of *Giardia lamblia* and their role during antigenic variation

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## Resumen

*Giardia lamblia* encodes several families of cysteine-rich proteins, including the Variant-specific Surface Proteins (VSPs) involved in the process of antigenic variation. Their characteristics, definition and relationships are still controversial. An exhaustive analysis of the Cys-rich families including organization, features, evolution and levels of expression was performed, by combining pattern searches and predictions with massive sequencing techniques. Thus, a new classification for Cys-rich proteins, genes and

pseudogenes that better describes their involvement in Giardia's biology is presented. Moreover, three novel characteristics exclusive to the VSP genes, comprising an Initiator element/Kozak-like sequence, an extended polyadenylation signal and a unique pattern of mutually exclusive transcript accumulation are presented, as well as the finding that High Cysteine Membrane Proteins, upregulated under stress, may protect the parasite during VSP switching. These results allow better interpretation of previous reports providing the basis for further studies of the biology of this early-branching eukaryote.

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