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PROJECT 1 ABSTRACT

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The long-term goal of this project is to provide a basis for the development of novel strategies to eliminate or prevent *Fusarium graminearum* infestation and associated toxin production in wheat and barley. We are focusing on upstream regulation of G protein signaling that can be manipulated to disarm fungal pathogenicity, defense, dispersion and toxicogenesis systems. This project is aimed at dissecting the roles of three additional **regulators of G protein signaling (RGS; Rgs3, Rgs4 and Rgs5)** in *F. graminearum*.

RGS proteins play a key role in controlling levels of various G protein mediated signals. We investigated three additional genes (*rgsA~C*) encoding RGS proteins in *Aspergillus nidulans*. Disruption of the *rgsA* gene resulted in elevated hyphal pigment accumulation and increased thermal and oxidative tolerance, but caused reduced levels of sterigmatocystin production in *A. nidulans*. We further studied the functions of RgsB and RgsC and found that these regulators play crucial roles in controlling normal sporulation, spore germination and fungal colonization (colony regeneration from spores). **The hypothesis behind this proposal is that the *F. graminearum* RGS proteins play central roles in controlling reproduction, pathogenicity, toxin production and stress response.** Through analysis of the *F. graminearum* genome database, we identified three genes encoding proteins highly similar to An-RgsA, B and C, and designated them as Fg-*RGS3*, *4* and *5*, respectively. We propose to delete these Fg-*RGS* genes and examine their roles in important pathogen traits including pathogenicity, mycotoxin production, sexual and asexual reproduction, and stress response. Pathogenicity tests will be carried out in collaboration with other *Fusarium* research labs. If individual deletion mutants show clear and dramatic changes, various double deletion mutants will be constructed either by sexual crosses or cumulative gene disruption via transformation. If one or more of five *F. graminearum* RGS proteins (Fg-Rgs1 ~ Fg-Rgs5) is proven to be a good target to control fungal infection in plants, further attempt will be made to silence these genes employing double-stranded RNA (dsRNA) based RNA-interference.

Outcomes of this research will **provide increased understanding of upstream control of pathogen biology that could lead to identification of innovative control strategies**. One can envision targeted dsRNA expression in barley and/or wheat that could be used to inactivate one or more RGS proteins in *F. graminearum* upon infection. We believe that this project will have a great impact on wheat and barley protection and improvement as well as improvement of human and animal health.