The proposed project is a continuation of the work initiated in FY06 to enhance resistance of barley to *Fusarium graminearum* by over-expressing the anti-fungal gene *GAFP* (gastrodianin anti-fungal protein). In the FY06 grant period (5/1/06 – 4/30/07) we have started transforming barley with an expression plasmid containing the coding region of *GAFP*. Expression of *GAFP* is expected to be localized to the spike tissue because of the use of a tissue-specific *Lem2* promoter we cloned from Morex barley (Abebe *et al*., 2005). *GAFP* was isolated from an orchid *Gastrodia elata*, which leads a symbiotic relationship with the fungus *Armillaria mellea*. The fungus can grow in older corms but infection of new corms is prevented by GAFP and other anti-fungal proteins. *In vitro* tests have demonstrated that *GAFP* effectively inhibits growth of saprophytic fungi, including *F. graminearum*. The objectives for the FY07 grant period are: 1) to characterize integration, expression and inheritance of *GAFP* in transgenic plants and 2) to test transgenic barley expressing *GAFP* for resistance against *F. graminearum*. Integration of GAFP to the genome of transgenic plants will be determined by Southern analysis of T1 and T2 plants. Expression will be monitored both at the mRNA level (by northern blotting and real-time PCR) and the protein level (using enzyme-linked immunosorbent assay). To test transgenic plants for their resistance to scab disease, spikes of T1 and T2 plants will be infected with *F. graminearum* in a growth chamber and greenhouse. The project will address the USWBSI Genetic Engineering and Transformation (GET) goal of developing transgenic barley with anti-*Fusarium* genes to limit *Fusarium* infection and early stages of growth and spread.