Project Abstract

Project Title:	Transfer Fhb7 to barley through CRISPR-mediated targeted gene insertion	
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Fusarium head blight (FHB; scab) is a devastating disease in barley and wheat. Significant progress has been made in understanding and improving host resistance in wheat with molecular cloning of the major QTL *Fhb1* and *Fhb7*; however, similar research with barley has lagged due mainly to the lack of highly resistant genotypes, which makes it very difficult to effectively control FHB and DON contamination. *Thus, there is an urgent need for a breakthrough in gene discovery and germplasm development to achieve higher levels of FHB resistance and a greater capacity to detoxify DON in barley using transformative approaches.*

The use of wheat genes to breed barley FHB resistance is the road not taken because of strong reproductive barriers. Considering that *Fhb7* detoxifies DON, we hypothesize that *Fhb7* can also contribute greatly to FHB resistance in barley. Taking the advantage of our ongoing work on *Fhb7* and CRISPR-based genome editing, we propose to continue our effort with an overall goal to transfer *Fhb7* to barley through CRISPR-mediated targeted gene insertion as a proof of concept. The proposed research includes three objectives:

1) Generate transgenic barley expressing both CRISPR/Cas9 and *Fhb7* donor. We **expect** to establish a CRISPR-mediated targeted gene insertion system and develop 90 transgenic plants by *Agrobacterium*-mediation and Biolistic bombardment.
2) Evaluate the *Fhb7* function in transgenic barley. We **expect** to deliver a package of new knowledge of *Fhb7* function in barley by examining T_0 and T_1 transgenic plants for FHB resistance and DON accumulation.
3) Screen the transgenic plants for targeted *Fhb7* insertion events. We **expect** to deliver a panel of *Fhb7*-insertion lines as novel germplasm by screening large populations for the *Fhb7* insertion events by PCR assays.

The project is transformational because it (1) uses a wheat FHB-resistance gene to improve the FHB resistance of barley, which is unprecedented, (2) utilizes CRISPR-mediated target gene insertion to develop novel FHB-resistance germplasm, and (3) aligns with the multiple priorities of several USWBSI programs, including GDER, VDHR, and BAR-CP. This project serves our **long-term goal** to improve the FHB resistance of barley and wheat using CRISPR-based approaches

As a team of expertise in gene discovery, germplasm, breeding, pathology, and genome editing, we have the materials, resources, and tools in place to make significant progress. Results from the proposed research will have a positive impact on barley production and the (malting, feed, and food) industry, benefiting barley growers and end-users.