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Project Title: High Efficiency Method for Generating FHB-Resistant Barley: Removing Bottlenecks in the Pipeline for Deploying FHB Resistance Genes.

PROJECT 1 ABSTRACT

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There is a pressing need for germplasm and genes that confer resistance to FHB, in wheat but even more so in barley, where there are relatively few natural sources of FHB resistance. Molecular genetic approaches allow FHB-resistance genes to be identified in other plant species, including research model plants. We have used this approach to identify a number of plant genes that contribute to effective resistance against *Fusarium graminearum*. These studies have been performed using either the model plant *Physcomitrella patens* (where genes can be stably overexpressed or knocked out by physical disruption) or wheat (where genes can be transiently suppressed through VIGS or overexpressed in stable transgenic plants).

Our ability to exploit these effective genes in barley, as well as identify new ones has been hampered by the lack of efficient barley transformation. Here, we propose to use the super-virulent AGL1 strain of *Agrobacterium tumefaciens* to transform the barley cultivar Conlon. This combination has been shown to be highly effective by researchers to the John Innes Center (JIC) in the UK and a distinct improvement on existing biolistic methods. Based on the JIC results, we expect to introduce up to a dozen genes into barley each year. We will use this approach to introduce genes whose overexpression or suppression or deletion has been effective in boosting immunity in *Physcomitrella* (Lawton lab) and in wheat (Scofield lab). The proposed genes include those involved in the expression of induced immunity, programmed cell death and the amelioration of reactive oxygen-induced damage. These genes have been selected because they have already been shown to be effective against FHB in either *Physcomitrella* or wheat. For these studies, we will use the most highly related barley or wheat homolog of genes already shown to be effective in other plants. Barley plants will be characterized for the presence and expression of the selectable marker gene and the transgene. Barley plants will be propagated, allowed to set seed and the progeny assayed for resistance to FHB in controlled and contained conditions. Initial transformation experiments have begun using 4 wheat genes for transformation. Both *Agrobacterium*-mediated methods and particle bombardment are being used with the cultivars Conlon and Golden Promise to ensure production of at least 10 insertion events per gene.