Project Abstract

Project Title:	Spherical nucleic acid nanomaterials as fungicide and FHB resistance-promoting agents	
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Co-Investigator:	Jyoti Shah	University of North Texas
Co-Investigator:	Brian Meckes	University of North Texas

This project proposes to develop novel spherical nucleic acid (SNA) nanomaterial-based technology to mitigate FHB. The specific goals are to develop SNA nanomaterials as fungicides that selectively target *F. graminearum*, and as agents that target susceptibility genes in wheat to promote resistance to FHB. These goals build upon our USWBSI-supported demonstration of the utility of RNA-interference (RNAi)-based approaches in plants to target *Fusarium graminearum* genes by host-induced gene silencing
(HIGS), and expression of wheat 'FHB susceptibility' genes for mitigating FHB.

Project Objectives:

1. Identify candidate siRNA sequences that effectively silence *F. graminearum* and wheat genes associated with severity of FHB.
2. Synthesize lipophilic SNA nanoparticles and evaluate their efficacy in silencing target gene expression to limit fungal growth and toxin accumulation, and enhancing FHB resistance in wheat.

The proposed project is relevant to the FY22 priorities of (1) PBG to '*Develop novel RNAi based strategies targeting critical genes for fungal growth, pathogenesis, and/or mycotoxin biosynthesis to control FHB and mycotoxin contamination*', and (2) GDER to '*Utilize new technologies to develop effective FHB resistance and/or reduced DON accumulation*'.

Expected Outcomes:
Objective 1. siRNA sequences that are selective for target fungal and wheat genes will be identified and their effectiveness in knocking down target gene expression validated.
Objective 2. The siRNA identified under objective 1 will be formulated into Lipophilic SNA nanomaterials that can be exogenously applied to control fungal growth, and mitigating FHB and DON accumulation.

Previously developed nanochemistry will be used to package siRNA into lipid-based SNA nanomaterials, their efficacy in knocking down expression of target fungal and wheat genes evaluated using molecular tools, and their efficacy in controlling fungal growth will be tested in culture, and in controlling FHB severity on wheat and mycotoxin accumulation tested in the greenhouse. The combined expertise of this team, which includes a nanotechnologist (Co-PI Meckes), and two established USWBSI-supported plant molecular biologists and pathologists (Shah and Scofield) will facilitate the timely accomplishment of project goals within the proposed period.