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Project ID: FY21-SH-010

ARS Agreement #: *New*

Research Category: TSCI

Duration of Award: 1 Year

Project Title: Spherical Nucleic Acid Nanomaterials as Fungicide and FHB Resistance-promoting Agents

PROJECT 1 ABSTRACT

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Project Goals: The goal of this project is to develop novel spherical nucleic acid (SNA) nanomaterial-based technology to control FHB. In order to achieve this goal, this project brings together the expertise of a nanotechnologist who is new to the USWBSI, and an established USWBSI-associated plant biologist/pathologist. This project builds upon recent findings, including those supported by the USWBSI, that demonstrate the utility of RNA-interference (RNAi)-based approaches in plants to: (i) knock down expression of *Fusarium graminearum* genes by a mechanism called host-induced gene silencing (HIGS), and (ii) knock down expression of wheat 'FHB susceptibility' genes for mitigating FHB. The specific goals of this project are to develop SNA nanomaterials as fungicides that selectively target *F. graminearum* growth, viability, and virulence, and as agents that target susceptibility genes to promote plant resistance to FHB.

Objectives: The following objectives will be pursued:

1. Identify siRNA sequence candidates that effectively target silencing of *F. graminearum* genes involved in growth, viability and virulence, and wheat genes involved in susceptibility to FHB
2. Synthesize lipid-based SNA nanoparticles and evaluate their efficacy in knocking down target gene expression, limiting fungal growth and enhancing plant resistance.

The proposed project is relevant to USWBSI's 'Transformative Science' goals to: (i) attract the expertise of early career scientists that are not part of the initiative, and (ii) recruit and explore new ideas and research approaches that leverage the strengths of the initiative. Co-PI Meckes, who is new to the USWBSI, brings to the initiative his expertise in SNA nanomaterial technology, which will be used to develop novel SNA nanomaterial-based approaches to mitigate FHB.

Expected Outcome: This project will develop SNA nanomaterials as fungicides that can selectively target *F. graminearum*, and as agents that can repress activity of FHB susceptibility genes in wheat to mitigate FHB.

Plan to Accomplish Project Goals Within Period of Proposed Work: The SNA nanomaterial technology, and the microbiology and molecular pathology tools required for accomplishing the proposed work are available in the PI/Co-PI's laboratories. These will facilitate the timely accomplishment of project goals within the proposed period.

Statement of Mutual Interest: The SNA nanomaterial approach of this project complements the activity of other USWBSI-sponsored projects for mitigating FHB. The successful development of the SNA technology will also facilitate activities of other USWBSI-projects by providing tools for rapidly assessing function of fungal genes in virulence and mycotoxin metabolism, and of wheat and barley FHB susceptibility genes.