RH19-5

AFRL CALL FOR RESEARCH

1. **Research Title:** Application of CRISPR/Cas9 Gene Editing in *In Vitro* Models to Elucidate Molecular Mechanisms of Engineered Materials

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Chemical, Biological Sciences and/or Materials Engineering (MS or Ph.D. level)

4. **Objectives:** General Specific investigation objectives include:

   - Utilize CRISPR "knock-out" library to screen for novel genes associated with NM sensitization.
   - Creation of individual knockout cell lines for nanotoxicity testing using CRISPR/cas9
   - Identify the molecular events involved in material/nano-interactions

5. **Description:** Technological advancements in genetic engineering have led to the recent development of the CRISPR/Cas9 gene editing system, a powerful new tool in molecular biology that will revolutionize both research and medicine. The CRISPR/Cas9 system makes it possible to create virtually any genetic alteration a scientist can imagine in any type of cell. The versatility of the CRISPR/Cas9 system makes it applicable to a broad range of research questions, and will be particularly useful in the Air Force Research Laboratory's new focus on synthetic biology. Little is known regarding the precise molecular mechanisms mediating toxicity of engineered nanomaterials. Most nanotoxicology research to date has focused on adverse outcome endpoints with few attempts to elucidate the complex molecular interactions leading to toxicity. This gap in the fundamental knowledge of nanotoxicity limits the predictive value of current toxicology research, impairs our ability to intelligently design new nanomaterials, and makes it more difficult to use engineered nanomaterials in new and innovative ways. Utilizing CRISPR/Cas9 to modify gene expression through the creation of knockout cell lines and gene replacement systems will permit a systematic, comprehensive study of molecular mechanisms of nanotoxicity for the first time.

6. **Research Classification/Restrictions:** *NA*

7. **Eligible Research Institutions:**

   X Universities (DAGSI) ☐ AFIT (only)

8. **Potential Commercial Impact and Industry Involvement:** The success of this project will lead to the development of nano-devices including bio-sensors that will have commercial value.

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