1. **Research Title:** Using Ordered Bacteria to Make Air Force Relevant Materials
2. **Individual Sponsor**

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3. **Academic Area/Field and Education Level:** Life Sciences, PhD

4. **Objectives:** Develop scalable cell-based ordered materials based on a fundamental understanding of self-assembling bacteria.

5. **Description:** A major lesson from nature is the importance of hierarchical assembly both to functionality and material properties. Indeed periodically ordered components in natural systems result in conspicuous properties that improve survival including toughness, thermal protection and signaling. Researchers have developed biomimetic materials which incorporate nature's design principles. Despite having a robust knowledge base and laboratory scale prototypes, manufacturing hierarchical materials remains challenging. Our team is interested in how self-assembled bacteria can circumvent challenges currently hindering replication of ordered materials in industrial settings. Our research efforts are focused on the marine bacteria *Cellulophaga lytica* (*C. lytica*). Its gliding motility combined with its high aspect ratio enables the bacteria to assemble into highly ordered biofilms which display vibrant, iridescent colors. This structural coloration is a consequence of light interacting with the sub-micron cell dimensions and the crystalline lattice formed by the organized cells. (Effectively, the bacterium is the unit cell of a crystalline lattice.) The facile growth of these bacteria in ambient conditions and across multiple length scales are major advantages to be exploited. Also, the ability to use genetic engineering to modulate cell dimensions and physiology suggest they could be a tunable platform relevant for a variety of materials. Ultimately, we seek to develop scalable cell-based technologies based on a fundamental understanding of the mechanisms involved in color generation by *C. lytica* biofilms. We are seeking motivated students and faculty to contribute to research projects in biomaterials development and characterization. The successful applicant will join a dynamic laboratory with a broad range of expertise in biomaterials, microbiology, biochemistry, molecular biology, biophysics and biochemistry. Selected participants will design and execute experiments using techniques from these disciplines. Duties may include but are not limited to: bacterial cell culture and manipulation, purification and analysis of cellular constituents, protein expression assays, biomaterials characterization, and/or bioinformatics. The selected participant will assist in interpreting experimental results and therefore must keep accurate and detailed records of experimental data. Communicating research data is very important and participants will do so in written, oral and visual formats.

6. **Research Classification/Restrictions:** This project involves 6.1 level unclassified research.

7. **Eligible Research Institutions:** Graduate students and faculty from any of the seventeen university members of the Ohio Department of Higher Education's Research Officers' Council (ROC) with graduate science and engineering programs are eligible to participate. ROC members include the Air Force Institute of Technology (AFIT); the University of Akron (UA); Bowling Green State University (BGSU); Central State University (CSU); the University of Cincinnati (UC); Cleveland State University (CSU); the University of Dayton (UD); Kent State University (KSU); Miami University (MU); The Ohio State University (OSU); Ohio University (OU); Shawnee State University (SSU); University of Toledo (UT); Wright State University (WSU); Youngstown State University (YSU); Case Western Reserve University (CWRU); and Northeastern Ohio Medical University.
8. **PA Approval #: e.g. AFRL-2024-4831**