

AFRL CALL FOR RESEARCH

1. **Research Title:** Airman-on-a-Chip for Human Performance
2. **Individual Sponsor:**

Dr. M. Tyler Nelson
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Airman Systems Directorate
711 Human Performance Wing
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3. **Academic Area/Field and Education Level:** Bioengineering, Biomedical Engineering, Molecular Biology, Cell Biology (MS or Ph.D. level)
4. **Objectives:** Specific investigation objectives include:
 - Develop Gut-Microbiome and Brain-on-a-Chip micro-devices
 - Characterize host and microbiota responses to Airman Operational Stress (thermal burden)
 - Conduct molecular techniques to quantify functional and performance-based analyses of Gut and Down-Stream Brain Tissue Responses
5. **Description:** The boundaries of weapons systems are constantly being pushed further ahead, the build-up of physical and mental stress on warfighters is extensive. Even as these weapons, aircraft, and technologies become “smarter,” faster, and more capable, they continue to be reliant on the human elements to enhance, operate and assess operations. As such, it is imperative to develop a “smarter” warfighter where adverse biological changes can be identified and augmented in real-time; ultimately ensuring the highest level of mission success. Extreme environmental or operational temperature exposures can effect warfighter awareness, cognition, and health. To date, the effects of thermal stress on warfighter gut-microbiome have yet to be established. Due to core-body temperature fluctuations alterations in metabolic activity, biochemical profiles, resiliency, and gut stability are likely to be effected limiting warfighter robustness. Understanding these effects requires robust models capable of capturing the physiological responses both spatially and temporally. We propose to develop a set of foundational microfluidic organ-on-chip platforms that will enable robust, rapid, and responsive assessment of operational stressors.
6. **Research Classification/Restrictions:** This opportunity is unclassified and open to U.S. citizens only. Proprietary information discussed when working with industry collaborators cannot be disclosed, and appropriate agreements will be in place before research begins. AFRL will provide appropriate guidance on public release and disclosure agreements.
7. **Eligible Research Institutions:**

Universities (DAGSI) AFIT (only)
8. **Potential Commercial Impact and Industry Involvement:** The success of this project will lead to the development of potential performance testing platforms and countermeasures.