WFIRM
Wake Forest Institute for Regenerative Medicine

DTRA
DEFENSE THREAT REDUCTION AGENCY
Detect. Deter. Defeat.

Organoid Focused Projects

A Defense Threat Reduction Agency award program - termed Pathogenesis and Toxicity Forecasting Using Multi-Organoid Systems, or PATMOS - uses WFIRM's Body-on-a-Chip platform to investigate the biochemical changes that take place in viral infections. Combining biological data with the computational power of machine learning and Artificial Intelligence should produce a powerful tool to find relationships between infection and human biology that have not previously been identified. This proof-of-concept research program provides a valuable tool for development of a predictive algorithm to more quickly react to any type of viral threat, laying the foundation for the development of medical countermeasures.

Another DTRA funded program, "Noah's Ark," utilizes organoids to understand the differences in how human tissues and organs respond compared to animal tissues and organs respond to different drugs which could improve the utilization of the FDA's "Animal Rule." By testing how organoids from different species behave, scientists can better select the animal model that most closely models human response to threats.

The institute received a $24 million research funding award from the Biomedical Advanced Research and Development Authority (BARDA), part of the HHS Office of the Assistant Secretary for Preparedness and Response, to validate how its lung-on-a-chip technology works in modeling the effects of chlorine gas – deemed a potential national security threat – on human lungs and to develop treatments.

LDP
LUNG DISCOVERY PROGRAM, SUPPORTED BY BARDA
WAKE FOREST INSTITUTE FOR REGENERATIVE MEDICINE

Currently, the study of respiratory health, disease and biomedical interventions is primarily performed in animal models or 2D cell culture models using human or animal cells. This model can be engineered to reflect both normal and diseased tissue and includes innate immune system responsiveness, and accurate and reproducible response to drugs and toxins.

According to BARDA, chlorine gas was used as a weapon during World War I and more recently the Syrian civil war. In addition, the amount of chlorine manufactured, along with its ready availability, makes this chemical a potential national security threat to the United States.

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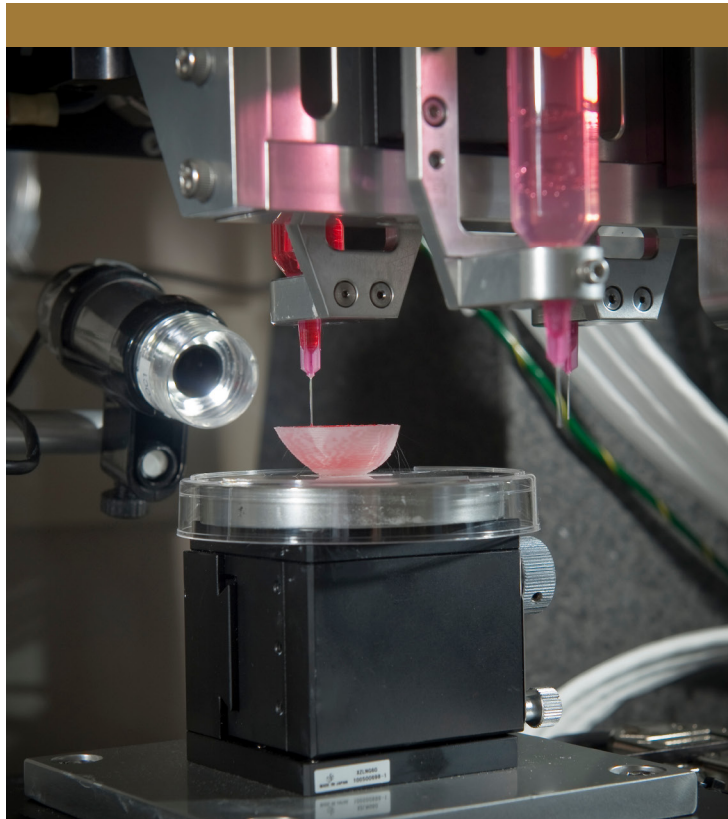
Our Science for their Healing



Why Regenerative Medicine?

Our scientists are working to harness the body's innate healing powers and use a patient's own cells to build new organs or promote healing from within. Skin, bladders, cartilage, urine tubes, muscle, vaginas, and kidney cells engineered in our lab have already been successfully implanted in patients.

Partnering with the Military to Heal our Wounded Warriors

The institute directs several high-profile, military-funded projects that are developing regenerative medicine therapies to heal our nation's wounded warriors:

Leader for AFIRM: The institute co-led the Armed Forces Institute of Regenerative (AFIRM) I research program, which began in

2008, and leads AFIRM II, which began in 2013. In total, the program led to 25 clinical trials and several hundred patients who received treatment with AFIRM-funded technologies. The AFIRM program consistently emphasized the importance of commercial transition and partnerships in the development of products and procedures that will lead to the functional and aesthetic recovery of the wounded warrior. To date, 20 consortium-supported projects have resulted in commercial partnerships, including start-up companies, to advance product development. Funded by the Army, Navy, Air Force and the NIH, AFIRM is a "results-focused" program that requires discoveries to be tested and compared so that the most promising therapies can be brought to clinical trials. AFIRM has resulted in multiple clinical trials of new therapies, including those to repair and rebuild

skin, nerves and blood vessels, and to mold facial structures. AFIRM II research focuses on developing new treatments for severely traumatized limbs, facial and skull injuries, burns, injuries to the genitals and lower abdominal organs, and preventing face and hand transplant rejection.

Printing Mini Organs for a "Body on a Chip": The institute led a $20 million project funded by the Defense Threat Reduction Agency to build a system of miniaturized human organs to model the body's response to both harmful agents and potential therapies. As a result, the institute's expertise in creating miniaturized organs is now being used in a variety of applications with the potential to improve human health. A liver on a chip, for example, could potentially mean a faster and more accurate way to test promising new drug therapies.

Bioprinting isn't just for mini-organs. In 2016, institute scientists made international headlines by proving the feasibility of creating living tissue structures to replace injured or diseased tissue in patients using a novel printer. The scientists have printed ear, bone and muscle structures that, when implanted in animals, matured into functional tissue and developed a system of blood vessels and nerves.

Advancing the Manufacturing of Regenerative Medicine Therapies: A public-private partnership, the Medical Technology Enterprise Consortium, which involves the U.S. Army Medical Research and Development Command, supports institute programs focused on developing standardized "bioinks" to use in 3D bioprinting and standardized cell culture media, a universal bioreactor platform for the maturation of regenerative medicine clinical products, and a cell isolation program to create an automated platform for isolating highly-defined cell populations for clinical manufacturing. The goal is to speed up the availability of replacement tissues and organs by standardizing manufacturing processes.