U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

USAMRMC

# Armed Forces Institute of Regenerative Medicine

## Mission

The Armed Forces Institute of Regenerative Medicine (AFIRM) is dedicated to repairing battlefield injuries through the use of regenerative medicine.

## Background and Environment

Conventional weapons and the destructive force of improvised explosive devices ravage face, neck, head, and limbs, causing massive trauma and tissue loss. Regenerative medicine has achieved success in the regeneration of human tissues and organs and has great potential for treating military personnel with these disfiguring and disabling injuries. Regenerative medicine uses tissue engineering to prompt the body to regenerate cells and tissues, often using the patient's own cells combined with degradable biomaterials. The ultimate goal is to deliver advanced therapies, whole organs, and engineered fingers and limbs to our wounded Warfighters.

In March 2008, the U.S. Army Medical Research and Materiel Command (USAMRMC) established the AFIRM to conduct research in regenerative medicine for the treatment of battlefield injuries. It was envisioned that integration between basic science research and translational and clinical research is required to bring effective regenerative medicine therapies to practice. The AFIRM is a virtual organization consisting of multiple universities working in conjunction with the U.S. Army Institute of Surgical Research (USAISR) under the framework of a 5-year cooperative agreement. The institute is expected to make major advances in wound repair and organ/tissue regeneration. New medical products are expected for patient use in as few as 5 years.

A total of 28 non-government institutions responded to the Request for Information that was released by the USAMRMC in February 2007. The final Program Announcement resulted in the receipt of seven full proposals. The proposals were screened for responsiveness and reviewed by a Science Review Board. Two finalists were invited to make oral presentations to the Program Review Board. These institutions, Wake Forest and Rutgers Universities, were selected as the non-government partners in the AFIRM.

The AFIRM is funded by a partnership of the USAMRMC, Office of Naval Research (ONR), the U.S. Air Force (USAF), the National Institutes of Health (NIH), and the Department of Veteran Affairs (VA), along with other participating institutions. The combined operating budget is approximately $160 million for 5 years.

The AFIRM's overall goal is to develop enhanced treatment of damaged tissues and organs by using therapies that prompt the body to regenerate lost or damaged tissues from a patient's own cells. This will be achieved by engineering regenerative techniques capable of regrowing muscle, nerves, blood vessels, cartilage, skin, and bone from stem cells taken from the patient (autologous grafting). This technique overcomes problems with rejection caused by grafting

cells from other individuals. These tissue constructs will be combined with active prostheses designed to interface with the site of regeneration and also be functional replacements during recovery. The forces and motion from the prosthesis aid and direct the regeneration of the replacement organ or limb. The 5-year goal is to perform clinical trials of autologous muscle, bone, cartilage, nerve, and blood vessel grafts. The longer-term goal is the functional regeneration of limbs.

## Key Themes and Messages

USAMRMC in partnership with the ONR, USAF, NIH, and VA, and Rutgers and Wake Forest Universities established the AFIRM in 2008 for repairing battlefield injuries through the use of regenerative medicine.

The non-governmental partnership of Wake Forest and Rutgers Universities will manage the research and development activities of the AFIRM. These universities will work closely with USAISR, which will provide the clinical and medical research environments.

The AFIRM will ensure that the technical innovations emerging from the research will transition as rapidly as possible into militarily relevant therapies and result in improving the lives of wounded members of the military.

The goal is for multiple therapies, with clearly defined clinical implementation (i.e., clinical trials and evidence-based changes in clinical practice), to be available within 5 years for rehabilitation and reconstruction problems resulting from battlefield trauma.

The AFIRM will specifically address compartment syndrome; functional limb and digit salvage, reconstruction, regeneration, or transplantation; facial reconstruction; healing without scarring; replacement of skin; and burn repair.

## Questions and Answers

***Q1. What problems will the AFIRM address?***

A1. Repair of wounds characterized by extensive tissue trauma must involve the generation of new and appropriately functioning tissues to fill the defect. Unfortunately, recovery from significant tissue loss is hampered the poor regenerative potential of humans that results in significant scarring and poor functional tissue replacement and outcome. Currently, such injuries require extended rehabilitation and multiple surgical procedures and can result in high morbidity and often in permanent disability.

***Q2. What are the technical barriers to solving this problem?***

A2. Four major transformational research and development activities must advance in concert to advance regenerative medicine:

(1) A better understanding of cell biology to provide the best cells and methods for developing appropriate tissues

(2) Biomaterials science to provide scaffolds so cells can populate and eventually produce tissues

(3) Bioreactors to grow and store the cells and tissues

(4) Implantation and transplantation science to effectively combine the cells, tissues, and scaffolds while overcoming problems with tissue rejection

Advancing each of these activities will require breakthroughs in fundamental knowledge and more complex investigations into preclinical and clinical applications of this technology.

***Q3. What is the payoff for the Warfighter?***

A3. The regenerative medicine products will decrease the ultimate debilitation, disfigurement, and disability that follow injuries characterized by significant tissue loss. Benefits will include:

- Quicker return to duty
- Fewer losses of personnel to permanent disability
- A decrease in costs for long-term care of wounded personnel
- An increase in Warfighter morale

***Q4. In what areas does the AFIRM plan to create clinical therapies?***

A4. Over the next 5 years, the AFIRM is committed to developing clinical therapies focusing on the following research areas:

- Burn repair
- Wound healing without scarring
- Craniofacial reconstruction
- Limb reconstruction, regeneration, or transplantation
  - Regeneration of large osseous defects
  - Nerve repair
  - Regrowth of functional muscles and tendons
  - Revascularization
- Compartment syndrome (a condition related to inflammation after surgery or injury that can lead to increased pressure, impaired blood flow, nerve damage, and muscle death)

***Q5. When did the research/study/collaboration begin?***

A5. Research began after the contracts were established in March 2008.

***Q6. Why is there a need for the AFIRM?***

A6. The AFIRM is necessary to create a critical mass of research expertise in the area of tissue regeneration that can focus on developing products to transform the lives of severely injured Warfighters.