

## Established Teams Working Together...

AFIRM encompasses two large academic-clinical consortia spanning 28 institutions, the U.S. Army Institute of Surgical Research (USAISR), and several dozen companies.

The U.S. Army Medical Research and Materiel Command (USAMRMC) directs the entire enterprise, facilitating synergies among the current partners and remaining open to new partners who can accelerate progress toward urgently needed therapeutic goals. There are five areas of emphasis:



### Craniofacial Reconstruction:

Massive bone and tissue loss to the face and head, often resulting from blast injuries, is a complex area to address since multiple levels and tissue types are involved and require different strategies for repair.



### Wound Healing Without Scarring:

Tissue injuries caused by trauma, surgery, and inflammation are a major problem to our Warfighters requiring new treatment options to prevent and manage scar formations.



### Limb Salvage and Reconstruction, Regeneration, or Transplantation:

Blast injuries often result in the loss of large regions of tissue in the middle portion of the limb, disrupting the healing and use of the hand or foot.



### Compartment Syndrome:

A secondary result of blast injuries, inflammation after surgery can lead to increased pressure, impaired blood flow, nerve damage, and muscle death.



**Burn Repair:** Despite recent advances, improvements in burn wound management are required to minimize acute complications and chronic functional impairment and reduce the high morbidity and mortality associated with burns.



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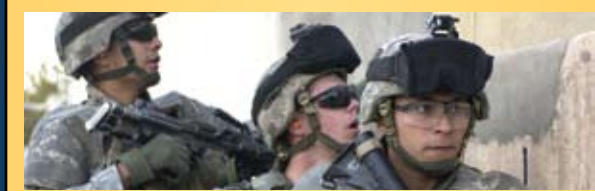


## Our Science for Their Healing

The Armed Forces Institute of Regenerative Medicine establishes national teams that are collaborating including leading scientists in the field of regenerative medicine. For more information about AFIRM, please contact:

[afirm@amedd.army.mil](mailto:afirm@amedd.army.mil)

[www.afirm.mil](http://www.afirm.mil)



The Department of Defense established the Armed Forces Institute of Regenerative Medicine (AFIRM) in 2008. AFIRM's mission is to develop new products and therapies to treat severe injuries suffered by U.S. service members in current wars. The concept of regenerative medicine—in its simplest form—is to replace or regenerate human cells, tissues, or organs to restore or establish normal function.

With the growing prevalence of complex, life-threatening injuries among our men and women serving in Iraq and Afghanistan, regenerative medicine has become a priority for military medical research and development. The need for advanced technologies such as tissue regeneration, bone scaffolding, and stem cell-enabled treatments is now more pressing than ever as service members become victims to severe blasts, often losing limbs and suffering severe burns.

The use of improvised explosive devices (IEDs) in Iraq and Afghanistan has caused a marked increase in severe blast trauma. Because of better body armor, quicker evacuation from the battlefield, and advanced medical care, many of the injured survive to face the challenge of overcoming severe limb, head, face, and burn injuries that can take years to treat and usually result in significant lifelong impairment.





## Partnership Participants

The two consortia that are working together with USAISR are made up of the following partnerships:

**WFP Consortium** (led by Wake Forest University and the McGowan Institute)

- Wake Forest Institute for Regenerative Medicine, Wake Forest University
- Wake Forest University of Health Sciences
- McGowan Institute for Regenerative Medicine, University of Pittsburgh
- Allegheny Singer Research Institute
- Berkley
- Carnegie Mellon University
- Georgia Institute of Technology
- Intercytex/Healthpoint
- Johns Hopkins
- Oregon Medical Laser Center
- Organogenesis
- Pittsburgh Tissue Engineering Initiative
- Regenerative Medicine Assets Limited
- Rice University
- Stanford University School of Medicine
- Tufts University
- University of Texas Health Science Center at Houston
- University of Wisconsin

**RCC Consortium** (led by Rutgers and the Cleveland Clinic)

- Rutgers/New Jersey Center for Biomaterials
- Cleveland Clinic Foundation
- Carnegie Mellon University
- Case Western Reserve University
- Dartmouth Hitchcock Medical Center
- Massachusetts General Hospital/Harvard Medical School
- Massachusetts Institute of Technology
- Mayo Clinic College of Medicine
- Northwestern University
- State University of New York at Stony Brook
- University of Cincinnati
- University of Medicine and Dentistry of New Jersey
- University of Virginia
- Vanderbilt University

Researchers include:

- 114 investigators, 30% of whom are clinicians
- 46 graduate students
- 70 postdoctoral students

The consortia fosters collaborations among the best in the field toward a common goal of treating our wounded Warriors through the use of regenerative medicine. Eight out of ten of the "Top Publishing U.S. Universities (2001–2007) in Stem Cells for Regenerative Medicine and Tissue Engineering" are participating in AFIRM as well as eight out of ten of the "Top Publishing U.S. Scientists."<sup>1</sup>

U.S. Rank	University	U.S. Rank	Researcher
<b>1</b>	<b>Harvard</b>	<b>1</b>	<b>David Kaplan</b>
<b>2</b>	<b>MIT</b>	<b>2</b>	<b>Rocky Tuan</b>
<b>3</b>	<b>Univ. Pittsburgh</b>	<b>3</b>	<b>Robert Langer</b>
<b>4</b>	<b>Columbia</b>	<b>4</b>	<b>Gordana Vunjak-Novakovic</b>
<b>5</b>	<b>Tufts</b>	<b>5</b>	<b>Johnny Huard</b>
<b>6</b>	<b>Georgia Tech</b>	<b>6</b>	<b>Michael Longaker</b>
<b>7</b>	<b>Rice</b>	<b>7</b>	<b>Jeffrey Gimble</b>
<b>8</b>	<b>Stanford</b>	<b>8</b>	<b>Joseph Vacanti</b>
<b>9</b>	<b>Case Western</b>	<b>9</b>	<b>Anthony Atala</b>
<b>10</b>	<b>Johns Hopkins</b>	<b>10</b>	<b>Antonios Mikos</b>

**Bold = AFIRM Participant**

Partnering with USAMRMC in financial support for AFIRM are the Office of Naval Research, the National Institutes of Health (NIH), the Air Force Surgeon General's Office, and the Veterans Health Administration (VA).

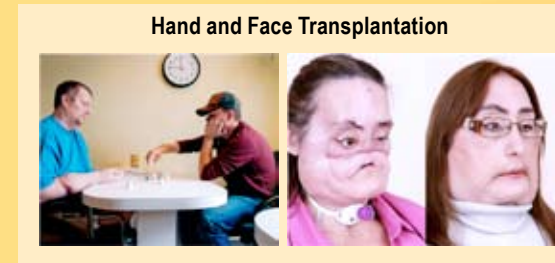
Total funding for the first 5 years of the AFIRM is close to \$300 million (M):

- \$100M from U.S. Government funding (Army, Navy, Air Force, VA, and NIH)
- \$80M from matching funds received from state governments and participating universities
- \$109M from pre-existing research projects directly related to deliverables of the AFIRM from the NIH, Defense Advanced Research Projects Agency, congressional special programs, the National Science Foundation, and philanthropy

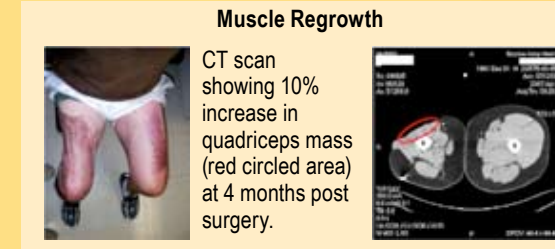
<sup>1</sup> World Technology Evaluation Center Report: International Assessment of Research and Development in Stem Cells for Regenerative Medicine and Tissue Engineering, Mar 2008.

## Sample of Current Projects

- **Clinical Trials for Hand and Face Transplantation for Reconstruction of Battlefield Trauma with Novel Immunomodulation**



- **Engineering Skeletal Muscle Replacements**



- **Burn Repair with Autologous Engineered Skin Substitutes and Cell-Spraying Devices:** The aim of this project is to develop an improved engineered skin substitute for improved recovery from large area burns.



AFIRM teams, working in research laboratories and clinics across the country, are advancing biological therapies (including adult stem cells and growth factors), tissue and biomaterials engineering, and transplantation methods that limit rejection to enable the body to repair, replace, restore, and regenerate damaged tissues and organs.

- **Adipose-Derived Therapies for Wound Healing, Tissue Repair, and Scar Management**
- **Optimizing Nerve Conduit Scaffolds for the Repair of Segmental Nerve Defects**
- **Use of a Tissue Scaffold to Create a New Nose or Ear**



Above, a polymer scaffold before and after seeding with chondrocytes for regeneration of a nose. Note the place for the nostrils at the bottom of the polymer scaffold. On the top right is an image showing an engineered human ear replacement in tissue culture. These artificially grown body parts are part of AFIRM's goal to regenerate the facial features of seriously injured service members such as the person shown on the right. The first clinical trials using this technology could start in about 2 years.

- **Facial Regeneration—Calvaria and Upper Face:** This project intends to fabricate a porous, injectable, and implantable system that will promote regeneration of parietal bones after injuries to the head and face.
- **Limb and Digit Tissue Regeneration/Reconstruction**
- **Novel Drugs to Minimize Burn Progression**
- **Advanced Degradable Scaffolds for Repair of Bone Defects**
- **Cellular Therapy for Treatment of Compartment Syndrome**

Through industrial partnerships, promising biomaterials and cell-based and combined regenerative medicine technologies can become new commercial products to restore lost tissue and function. These products and therapies will rapidly become available to civilian trauma and burn patients as well.