Award Number: W81XWH-12-2-0128

TITLE: Instructive Biologic Scaffold for Functional Tissue Regeneration Following Trauma to the Extremities

PRINCIPAL INVESTIGATOR: CAPT Mark Fleming, CAPT, MC, USN

CONTRACTING ORGANIZATION: The Geneva Foundation
Tacoma, WA 98402

REPORT DATE: September 2015

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

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# Report Date

**1. REPORT DATE**
September 2015

**2. REPORT TYPE**
Annual

**3. DATES COVERED**
30 Sep 2014 - 29 Aug 2015

### 4. TITLE AND SUBTITLE
**Instructive Biologic Scaffold for Functional Tissue Regeneration Following Trauma to the Extremities**

### 6. AUTHOR(S)
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Leon Nesti
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leon.j.nesti.mil@mail.mil

### 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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### 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012

### 12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release, Distribution Unlimited

### 14. ABSTRACT
Our hypothesis is that subjects who receive the SIS-ECM scaffold material will have significant new muscle growth and improvements in strength in the treated extremity. The proposed prospective, non-randomized, two-armed study in forty (40) subjects will establish the safety and effectiveness of a regenerative scaffold for the restoration of functional musculotendinous tissue, including the restoration of blood supply and innervation. Cohort 1 will include 20 subjects with upper extremity flexor and extensor traumatic, postoperative, or other avulsive VML. Cohort 2 will include 20 subjects with open femur fractures or soft tissue injury to the thigh resulting in VML. The primary endpoint will be changes in graft site muscle volume compared to baseline at 6 and 12 months as determined by imaging.

### 15. SUBJECT TERMS
Regenerative Medicine; Extracellular Matrix; Volumetric Muscle Loss

**16. SECURITY CLASSIFICATION OF:

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1. **INTRODUCTION:** The purpose of this investigation is to evaluate the effectiveness of a regenerative biologic scaffold, Biodesign® 6-layer Plastic Surgery Matrix [Cook Biotech]; Premarket Notification Trade/Device Name: SIS Plastic Surgery Matrix, derived from small intestinal submucosa extracellular matrix (SIS-ECM), for the restoration of functional musculotendinous tissue in participants with an acute or subacute volumetric muscle loss (VML) injury. The proposed research is a prospective, multi-center, non-randomized, single-armed, two-cohort clinical trial with a targeted population of forty (40) evaluable subjects. Cohort 1 will include 20 subjects with upper extremity traumatic, postoperative, or other avulsive VML injury. Cohort 2 will include 20 subjects with lower extremity traumatic, postoperative, or other avulsive VML injury. This study will be conducted at 2 study sites: Walter Reed National Military Medical Center (WRNMMC) and the R Adams Cowley Shock Trauma Center (STC) at the University of Maryland Medical Center. Study participants will be enrolled and followed for a period of 1 year (12 months). This study will evaluate the effectiveness of Biodesign®, a 6-layer regenerative biologic scaffold derived from small intestinal submucosa extracellular matrix (SIS-ECM), for the restoration of functional musculotendinous tissue in forty (40) participants, both male and female, with an acute or subacute volumetric muscle loss (VML) defects in their upper or lower extremities. The targeted subject population will consist of injured service members or civilian victims of trauma. All subjects enrolled will receive the SIS-ECM scaffold, trimmed to fit the defect, and will serve as their own control. Only one segmental muscle defect will be treated in each subject, and each subject may receive multiple SIS-ECM grafts at the injury site. Enrolled participants will be assigned to 1 of 2 Cohort groups. Cohort 1 will include 20 subjects with upper extremity traumatic, postoperative, or other avulsive VML injury. Cohort 2 will include 20 subjects with open femur fractures or soft tissue injury to the thigh resulting in VML. The primary endpoint will be changes in graft site muscle volume compared to baseline at 6 and 12 months as determined by imaging. Secondary endpoints will include histopathological characterization of the muscle healing response at the graft site, clinician and subject evaluation of cosmesis, and comparison of complication rates to clinical site historical standard of care.

What was accomplished under these goals?

**Specific Aim 1:** To induce the *de novo* formation of at least 25% of the missing muscle tissue using an inductive ECM scaffold. This tissue will be morphologically and structurally identical to native skeletal muscle tissue.

**KEYWORDS:** Regenerative Medicine; Extracellular Matrix; Volumetric Muscle Loss

**ACCOMPLISHMENTS:**

What were the major goals of the project?

Our hypothesis is that subjects who receive the SIS-ECM scaffold material will have significant new muscle growth and improvements in strength in the treated extremity. The proposed prospective, non-randomized, two-armed study in forty (40) subjects will establish the safety and effectiveness of a regenerative scaffold for the restoration of functional musculotendinous tissue, including the restoration of blood supply and innervation. Cohort 1 will include 20 subjects with upper extremity flexor and extensor traumatic, postoperative, or other avulsive VML. Cohort 2 will include 20 subjects with open femur fractures or soft tissue injury to the thigh resulting in VML. The primary endpoint will be changes in graft site muscle volume compared to baseline at 6 and 12 months as determined by imaging. Secondary endpoints will include histopathological characterization of the muscle healing response at the graft site, clinician and subject evaluation of cosmesis, and comparison of complication rates to clinical site historical standard of care.

Unpublished data
Briefly, Cook BioDesign’s Plastic Surgery Matrix® device will be implanted surgically. Change in muscle volume from baseline at device implantation as determined by MRI or CT will be assessed. Biopsied tissue will be fixed and the tissue specimens will be subjected to a battery of immunohistochemical, immunolabeling, and traditional histochemical stains for the identification of cell phenotype, extracellular matrix characterization, and histomorphometric analysis. The main endpoint of this study is to determine the percentage of volume restored at the surgical site.

Task 1: IRB and Facility Approvals (months 1-4)

1a. IRB Approval (months 1-4)
   Facility: Walter Reed National Military Medical Center (WRNMMC)
1b. IRB Approval (months 1-4)
   Facility: Maryland Shock Trauma (MST)
1c. Approval by USAMRMC Office of Research Protections (months 4-5)

The overall study protocol is being developed and written by WRNMMC as the coordinating center and will then be sent to the MST for inclusion into their site specific protocol. MST cannot submit the protocol to the IRB, until the WRNMMC master protocol has been approved by WRNMMC’s IRB Oversight Committee and DoD HRPO. The protocols are drafted and being finalized with investigators and collaborators for submission. As required prior to IRB submission, the WRNMMC protocol was submitted to the departmental Scientific Review Committee (SRC) for review and received back with minimal questions and edits. The WRNMMC protocol and CRFs are being finalized for IRB administrative and committee review. Kick-off meetings via conference call were conducted on 16 September 2014 with WRNMMC personnel and on 30 October 2014, including current PI, Mr. Janis, and transitioning PI, CDR Fleming, to discuss study roles and responsibilities. Another meeting was conducted on 13 November 2014 between WRNMMC study personnel with the addition of WRNMMC personnel Dr. Dearth and Ms. Pruziner to clarify roles. Additional meetings were conducted on 04 February 2015, 19 February 2015, 12 March 2015, 2 April 2015, 04 June 2015, 11 June 2015, 23 June 2015, 29 October 2015 with WRNMMC study personnel to discuss and clarify study protocol specifics and progress. Conference call meetings were conducted on 04 March 2015, 02 September 2015, 16 September 2015, 30 September 2015 between WRNMMC and MST, including WRNMMC PI CDR Fleming and MST PI Dr. Sciadini, to discuss study protocol and site coordination specifics. An in-person investigators’ meeting between WRNMMC and MST was conducted on 27 August 2015, including WRNMMC transitioning PI, LTC Nesti, MST PI Dr. Sciadini, WRNMMC investigator Dr. Dearth, and WRNMMC and MST study coordinators, Ms. Lee and Ms. Ordonio to discuss changes in study personnel and progress. Another in-person investigators’ meeting between WRNMMC and MST was conducted on 23 September 2015 at MST with Dr. Dearth and Ms. Pruziner presenting and discussing study protocol with MST investigators. A conference call meeting was conducted on 05 August 2015 with the addition of STATKING personnel to clarify roles and responsibilities. In-person meetings to discuss CRFs were conducted on 04 September 2015 with WRNMMC & MST study personnel and on 21 September 2015 with WRNMMC study personnel.

Task 2: Patient Enrollment (months 5-23)

2a. Patient Enrollment (months 5-23)
   Facility: Walter Reed National Military Medical Center
2b. Patient Enrollment (months 5-23)
   Facility: Maryland Shock Trauma
# Clinical Patients: 40
Patient Enrollment has not yet begun.

Task 3: Patient Follow Up (months 8-31)

Unpublished data
3a. CT Guided Biopsy (months 8-31)
   Facility: Walter Reed National Military Medical Center
3b. MRI, MRI Guided Biopsy (months 8-31)
   Facility: Maryland Shock Trauma
   # Clinical Patients: 40
Patient Follow Up has not yet begun.

Task 4: Histology/Pathology (months 8-35)
   4a. Histology (months 8-35)
       Facility: WRNMMC
   4b. Pathology (months 8-35)
       # Tissue Samples: 80
Histology and Pathology has not yet begun.

Task 5: Final Report (months 35-37)
   5a. Review of Data and Generation of Final Report (months 35-37)
       Facility: WRNMMC
       Pathology reports, functional test scores, and imaging data will be assessed by Dr. Leon Nesti and study personnel. These data will be tabulated and forwarded to the biostatistician for statistical analysis as described in the statistical plan. A final report incorporating these data will be prepared, reviewed and accepted by the PIs at WRNMMC and Maryland Shock Trauma.
Review of Data and Final Report has not yet begun.

Specific Aim 2: To restore at least 25% of the function of the involved muscle group through the use of an inductive ECM scaffold material.

Briefly, functional recovery in the injured extremity will be compared at 1, 4, 8, and 12 months. At 12 months, function of the injured extremity will be compared to the contralateral limb, if present. The main endpoint of this study is to determine the percentage of function restored to the surgical site.

Task 6: Patient Follow Up (months 8-31)
   6a. Functional and Physician Assessment (months 8-31)
       Facility: Walter Reed National Military Medical Center
   6b. Functional and Physician Assessment (months 8-31)
       Facility: Maryland Shock Trauma
   # Clinical Patients: 40
Patient Follow Up has not yet begun.

Task 7: Final Report (months 31-47)
   7a. Review of Data and Generation of Final Report (months 31-47)
       Facility: WRNMMC
       Pathology reports, functional test scores, and imaging data will be assessed by the research team at WRNMMC. These data will be tabulated and forwarded to the biostatistician for statistical analysis as described in the statistical plan. A final report incorporating these data will be prepared, reviewed, and accepted by investigators.
Review of Data and Final Report has not yet begun.

What opportunities for training and professional development has the project provided?

Unpublished data
Training and professional development activities occurred between current and former investigators and collaborators at the Military Health System Research Symposium (MHSRS), Ft Lauderdale, Florida in August 2015 and also at the Tissue Engineering and Regenerative Medicine International Society (TERMIS) World Conference, Boston, Massachusetts in September 2015.

**How were the results disseminated to communities of interest?**

Nothing to Report.

**What do you plan to do during the next reporting period to accomplish the goals?**

The WRNMMC protocol will be submitted for WRNMMC IRB administrative and committee review. After the WRNMMC master protocol has been approved by WRNMMC’s IRB Oversight Committee and DoD HRPO, it will be sent to the MST for inclusion into their site specific protocol and MST IRB submission.

4. **IMPACT:**

**What was the impact on the development of the principal discipline(s) of the project?**

Nothing to Report.

**What was the impact on other disciplines?**

Nothing to Report

**What was the impact on technology transfer?**

Nothing to Report

**What was the impact on society beyond science and technology?**

Nothing to Report

5. **CHANGES/PROBLEMS:**

**Changes in approach and reasons for change**

Functional recovery in the injured extremity will be compared at 1, 4, 8, and 12 months as opposed to 3, 6, 9 months as originally stated in the SOW. Based on previous studies, earlier remodeling time points are of greater scientific interest.

Primary endpoint will be to restore at least 25% of the function of the involved muscle group. Secondary endpoints will include to induce the *de novo* formation of at least 25% of the missing muscle tissue using an inductive SIS-ECM scaffold, as determined by quantitative image analysis.

Unpublished data
compared to baseline at 8 and 12 months.

**Actual or anticipated problems or delays and actions or plans to resolve them**

We are anticipating delays in the establishment of a CRADA due to transitioning of personnel in the CRADA office as well as transitions between current approved template standards and new DHA standards. We are working to mitigate this issue by having continuous, ongoing conversations with WR staff to ensure we are on the correct path forward and no efforts have been lost. We also anticipate changes in histology assessment due to budgetary constraints and will identify an alternate route within such budgetary constraints. Additionally, we are working to mitigate the issue of outstanding MIPR’d funds to WRNMMC for study purposes and investigating the avenues and options to resolve the matter. We are doing this by initiating conversations with DRP, Resource Management Officers on site and CDMRP to help resolve the issue. To date, we have not been able to confirm the ability to receive and route funds appropriately, but hope to have resolution to this issue in the coming months.

**Changes that had a significant impact on expenditures**

Due to the delay in IRB submission, anticipated costs have been significantly lower than expected. We have delayed hiring staff. Our sub recipient has also delayed their timeline and costs while we work to finalize the Coordinating Center protocol. Once these milestones have been met, we anticipate an increase in costs as the program moves forward.

**Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents**

Nothing to Report

6. **PRODUCTS:**

Nothing to Report

7. **PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS**

**What individuals have worked on the project?**

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<tr>
<th>Name:</th>
<th>CAPT Mark Fleming, CAPT, MC, USN</th>
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<tr>
<td>Project Role:</td>
<td>Principal Investigator (PI) / Site Principal Investigator at WRNMMC</td>
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<tr>
<td>Nearest person month worked:</td>
<td>12 months</td>
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<tr>
<td>Contribution to Project:</td>
<td>Dr. Fleming is an orthopedic trauma surgeon, was the site Principal Investigator (PI) at WRNMMC and then transitioned to take over the role of study PI from Abram Janis.</td>
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<th>Name:</th>
<th>LTC Leon Nesti, MD, PhD</th>
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<td>Project Role:</td>
<td>Principal Investigator (PI) / Site Principal Investigator at WRNMMC</td>
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<tr>
<th>Name:</th>
<th>Contribution to Project:</th>
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<tr>
<td>Marcus Sciadini, MD</td>
<td>Dr. Sciadini is an orthopedic trauma surgeon and the site Principal Investigator (PI) at MST, provided clinical expertise and input on study protocol and design.</td>
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<td>Barry Martin, COL, MC, USA</td>
<td>Dr. Martin, is a reconstructive plastic surgeon, has provided expertise in soft tissue reconstruction, clinical applications of regenerative medicine, and provided input on study protocol and design.</td>
</tr>
<tr>
<td>Ian Valerio, MD, MS, MBA, FACS CDR, MC, USNR</td>
<td>Dr. Valerio, is a reconstructive plastic surgeon, former Co-Investigator (Co-I) at WRNMMC, and has provided expertise in soft tissue reconstruction, clinical applications of regenerative medicine, and provided input on study protocol and design.</td>
</tr>
<tr>
<td>Christopher Dearth, PhD</td>
<td>Dr. Dearth is a Scientist Subject Matter Expert at WRNMMC, facility research director, has expertise in muscle regenerative research, provided input on study protocol and design, and will assist with processing biopsies, histological evaluations and publications.</td>
</tr>
<tr>
<td>Alison Pruziner, PT, DPT, ATC</td>
<td>Alison is a research physical therapist at WRNMMC, has expertise in physical therapy research, provided input on study protocol and design.</td>
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Unpublished data
study protocol and design, and will assist with subject visits, functional assessments, and training PT personnel.

Name: Shannon M. Lynch, PT, DPT, OCS
Project Role: Associate Investigator, Physical Therapist & Service Chief at WRNMMC
Nearest person month worked: 12 months
Contribution to Project: LTC Lynch is a physical therapist and service chief at WRNMMC, has expertise in physical therapy research, provided input on study protocol and design, and will assist with subject visits, functional assessments, and training PT personnel.

Name: Michael Stidham, PT
Project Role: Associate Investigator & Physical Therapist at WRNMMC
Nearest person month worked: 5 months
Contribution to Project: Michael is a physical therapist at WRNMMC, has experience in physical therapy research, provided input on study protocol and design, and will assist with subject visits and functional assessments.

Name: Caitlin Mahon, MS
Project Role: Research Biomedical Engineer at WRNMMC, DoD-VA Extremity Trauma & Amputation Center of Excellence
Nearest person month worked: 3 months
Contribution to Project: Nanc has performed work as a research coordinator at WRNMMC, facilitated communications between investigators, assisted with the protocol, CRFs, notes and reports.

Name: Nancy Lee
Project Role: Research Associate / Coordinator at WRNMMC
Nearest person month worked: 12 months
Contribution to Project: Nancy Lee has performed work as a research coordinator at WRNMMC, facilitated communications between investigators, assisted with the protocol, CRFs, notes and reports.

Name: Katherine Ordonio
Project Role: Clinical Research Specialist / Coordinator at MST
Nearest person month worked: 2 months
Contribution to Project: Katherine Ordonio has performed work as a research coordinator at MST, facilitated communications between investigators, assisted with the protocol and CRFs.

Name: Linzie Wagner
Project Role: Grants and Contracts Manager at the Geneva Foundation
Nearest person month worked: 12 months
Contribution to Project: Linzie Wagner has performed work as a grants and

Unpublished data
contracts manager at the Geneva Foundation, managed budgets, executed subcontracts, facilitated communications between investigators and submitted reports.

Name: Daisy Schlessinger  
Project Role: Lead Data Manager/Project Manager at STATKING Clinical Services  
Nearest person month worked: 2 months  
Contribution to Project: Daisy Schlessinger has performed work providing clinical data and monitoring expertise at STATKING Clinical Services.

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

There has been a change in PI that occurred in Year 1, Quarter 4. Principal Investigator, CAPT Mark Fleming, received a transfer within the Navy to the University of Southern California and left Walter Reed National Military Medical Center effective September 2015. A request to change the PI on this award from CAPT Fleming to LTC Leon Nesti was submitted on 25 August 2015 to the sponsor. LTC Nesti is a hand and upper extremity orthopedic reconstructive surgeon at WRNMMC, Associate Professor and Chief of Clinical and Experimental Orthopaedics at Uniformed Services University. Dr. Nesti’s current and past clinical and research experience is well-suited for this trial and a smooth transition is anticipated. Dr. Nesti’s Bio, CV, and Support documents are attached for reference (see Appendix A-C).

Associate Investigator, CDR Ian Valerio, left Walter Reed National Military Medical Center effective December 2014 and transitioned from Navy active duty to Navy reserves.

Initial PI, Abram Janis, left the project and transferred the PI to CDR Mark Fleming in December 2014. A request to change the PI this award from Mr. Janis to CDR Fleming was submitted on 05 December 2014 to the sponsor. Mr. Janis provided a letter of support and relinquishment as PI and CDR Fleming provided the signed PI Safety Assurance. Approval for the modification requesting the change of PI was received on 28 January 2015.

What other organizations were involved as partners?

Organization Name: The Geneva Foundation  
Location of Organization: 917 Pacific Ave, Suite 600 Tacoma, WA 98402  
Partner’s contribution to the project: Financial support (i.e. grants and contracts management)

Organization Name: R Adams Cowley Shock Trauma Center (STC), University of Maryland Medical Center  
Location of Organization: 22 S. Greene Street, Baltimore, MD 21201  
Partner’s contribution to the project: Facilities (i.e. external site - subaward was submitted to MST on 03 December 2014 and was executed on 15 April 2015); Collaboration (i.e. partner’s staff work with project staff on the project); Personnel exchanges (i.e. project staff will work with partner’s staff at external site)

Organization Name: STATKING Clinical Services  
Location of Organization: 759 Wessel Drive, Fairfield, OH 45014

Unpublished data
Partner’s contribution to the project: Collaboration (i.e. partner’s staff work with project staff on the project); Clinical Monitoring & Data Management

Organization Name: Cook Biotech, Inc.
Location of Organization: 1425 Innovation Place, West Lafayette, IN 47906
Partner’s contribution to the project: Vendor (Instructions For Use (IFU) for Biodesign® Plastic Surgery Matrix was obtained from Cook® Medical on 07 May 2015)

5. SPECIAL REPORTING REQUIREMENTS: None

APPENDICES:

- Appendix A: Dr. Nesti’s Bio
- Appendix B: Dr. Nesti’s CV
- Appendix C: Dr. Nesti’s Support
LTC Leon Nesti, MD, PhD: Dr. Leon Nesti received his BS from the United State Military Academy at West Point, and his MD PhD through the clinician-scientist training program at Thomas Jefferson University and Jefferson Medical College. After completing his Orthopaedic Surgery residency at Walter Reed Army Medical Center, Dr. Nesti continued his subspecialty training in Hand and Upper Extremity Reconstructive Surgery in the combined Walter Reed, Curtis National Hand Center program. Dr. Nesti served as the Chief of the Orthopaedic Research Group at the National Institutes of Health/National Institute of Arthritis and Musculoskeletal and Skin Diseases and now serves as the Chief of Clinical and Experimental Orthopedics Laboratory at the Uniformed Services University of the Health Sciences. He is a Hand and Upper Extremity Reconstructive surgeon at Walter Reed National Military Medical Center and performs duties as the Co-Surgical Chief of the Walter Reed Peripheral Nerve Clinic and the Upper Extremity consultant for the United States Military Academy and its athletic teams. He is an active participant in the Army's PROFIS system and recently returned from Afghanistan where he functioned as the 936 Forward Surgical Team’s Orthopaedic Surgeon. Dr. Nesti’s clinical and scientific interests are focused on progenitor cell function in musculoskeletal disease and regeneration.
Curriculum Vitae
Leon J. Nesti, MD PhD
LTC, MC
(July 2015)

CONTACT INFORMATION

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4301 Jones Bridge Road  
Bethesda, MD 20814  
(240) 994-7347  
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leonnesti@gmail.com  
leon.j.nesti.mil@mail.mil  
leon.nesti@usuhs.edu |

EDUCATION

BACHELOR OF SCIENCE (ACS CHEMISTRY) – 1995  
United States Military Academy, West Point, New York

DOCTOR OF MEDICINE – 2002  
Jefferson Medical College of Thomas Jefferson University  
Philadelphia, PA

DOCTOR OF PHILOSOPHY – 2000  
College of Graduate Studies of Thomas Jefferson University

PROFESSIONAL SOCIETIES

Association of Graduates, United States Military Academy – 1995  
American Society of Cell Biology – 1998 to Present  
Orthopaedic Research Society – 2001 to Present  
Society of Military Orthopaedic Surgeons – 2001 to Present  
American Military Surgeons of the United States – 2002  
American Academy of Orthopaedic Surgery - 2012 to Present
American Society for Bone and Mineral Research – 2003 to Present
American Society for Surgery of the Hand – 2013 to Present
American Orthopaedic Association -- 2015 to Present

**CERTIFICATION AND TRAINING**

- Master Fitness Trainer – 1995
- NAUI Dive Certification – 1995
- Basic Life Support – 2001
- Advanced Cardiac Life Support - 2001
- USMLE Steps I-III Pass
- ABOS Diplomat 2012

**Appointments**

- Program Director, Walter Reed Section Combined Walter Reed/Curtis National Hand Center Hand Fellowship
  Walter Reed National Military Medical Center
  Bethesda, MD May 2015-Present

- Chief, Clinical and Experimental Orthopaedics
  Department of Surgery
  Uniformed Services University of the Health Sciences
  Bethesda, MD Oct 2014-Present

- Chief, Clinical and Experimental Orthopaedics
  National Institute of Arthritis, and Musculoskeletal & Skin Diseases
  National Institutes of Health
  Bethesda, MD Aug 2009-2014

- Associate Professor
  Department of Surgery
  Uniformed Services University of the Health Sciences
  Bethesda, MD February 2014- Present

- Assistant Professor
  Department of Surgery
  Uniformed Services University of the Health Sciences
  Bethesda, MD February 2005-2014

- Special Volunteer
  National Institute of Arthritis, and Musculoskeletal & Skin Diseases
  National Institutes of Health
  Bethesda, MD June 2004-2009
POSSESSIONS

Guest Investigator
NMRC
Silver Spring, MD January 2005-2008

Clinical Instructor
Uniform Services University of the Health Sciences
Bethesda, Maryland October 2002-2005

Billeted Faculty
Department of Surgery
Uniformed Services University of the Health Sciences
Bethesda, MD
Aug 2011-Present

Adjunct Principle Investigator
National Institute of Arthritis, and Musculoskeletal & Skin Diseases
National Institutes of Health
Bethesda, MD
Aug 2009-2014

Hand and Upper Extremity Reconstructive Surgeon
United States Military Academy at West Point
Aug 2010-Present

Hand and Upper Extremity Reconstructive Surgeon
Kimbrough Ambulatory Care Center
Ft. Meade, MD
October 2010-Present

Hand and Upper Extremity Reconstructive Surgeon
Walter Reed National Military Medical Center
Bethesda, MD
October 2010-Present

Hand and Upper Extremity Reconstructive Surgeon
McDonald Army Health Clinic
Ft. Eustis, VA
Aug 2009-Aug 2011

Hand and Upper Extremity Reconstructive Surgery Fellow
Curtis National Hand Center, Baltimore, MD
Walter Reed Army Medical Center, Washington, DC
Aug 2008-Aug 2009
Orthopaedic Surgery Resident  
Walter Reed Army Medical Center  
Washington, D.C. June 2002-June 2008

Postdoctoral Fellow  
National Institutes of Health  
National Institutes of Arthritis, musculoskeletal and skin Diseases  
Cartilage Biology and Orthopaedics Branch  
Washington, D.C. June 2004-June2005

Graduate Student, Doctor of Medicine  
Jefferson Medical College of Thomas Jefferson University  

Graduate Student, Doctor of Philosophy  
College of Graduate Studies of Thomas Jefferson University  

Cadet, United States Military Academy  

**MILITARY EXPERIENCE**

**Education:** Captain’s Career Course - 2010  
Combat Casualty Care Course- 2002  
AMEDD Officer Basic Course – 1996

**Awards:** National Defense Service Medal  
Army Service Ribbon  
Army Achievement Medal  
Army Commendation Medal  
Global War on Terrorism  
NATO Medal  
Afghanistan War Medal

**Deployment:** 936th Forward Surgical Team, Meymaneh, Afghanistan  
2011

**AWARDS**

United States Bone and Joint Decade Young Investigator Award 2007.

Society of Military Orthopaedic Surgeons, Founder’s Award 2006.  
“Activin Receptor Expression in Heterotopic Ossification”


AAOS/OREF Clinician Scientist Development Award, 2005.

Hyman Menduke Research Prize. Recognition for outstanding Research performed while a medical student at Jefferson Medical College. June 2002


Army Health Profession Scholarship (HPSP)
Tuition, supplies, and stipend support for studies leading to a M.D. degree. 1995-2002

Office of the Dean Travel Award: 2000 – Thomas Jefferson University. Presented to a deserving medical student who has had his research accepted for presentation at a national meeting.

Jefferson Alumni Travel Award: 1999 – Thomas Jefferson University. Presented to a deserving graduate student who has had his research accepted for presentation at a national meeting.

GRANTS/FUNDING

Clinical Evaluation of Decellularized Nerve Allograft with Autologous Bone Marrow Stem Cells to Improve Peripheral Nerve Repair and Functional Outcomes CDMRP, MR140132 2015-2018 (PI - $2,500,000)

Early Identification of Molecular Predictors of Heterotopic Ossification following Extremity Blast Injury: Animal Model Correlation with Human Disease. CDMRP, OR120071P1. 2013-2016. (Partnering-PI - $450,000)

Mesenchymal Progenitor Cell Therapy in the Prevention of Tissue Fibrosis, DMRDP, D10-I-AR-J8-981 2011-Present. (PI - $750,000)
Virtual Stress Test of Healing Fractures, G190VV USAMRRA 2010-2014 (PI – $110,000)


Congressionally Directed Medical Research Program “Small Molecule Therapy in the Prevention of Heterotopic Ossification” 00519318 , 2009-2010, (PI- $150,000).


National Institutes of Health, MD, PhD Predoctoral Fellowship Medical Scientist Training program providing tuition, research supplies, and stipend support for studies leading to a combined M.D./Ph.D. degree. NIH-NRSA F30AA05516, 1997-2001

**DOCTORAL DISSERTATION**


**JOURNAL ARTICLES (Published/Accepted):**

- h-index: 22


32. Lozito TP, Jackson WM, Nesti LJ, Tuan RS. Human mesenchymal stem cells generate a distinct pericellular zone of MMP activities via binding of MMPs and secretion of high levels of TIMPs. Matrix Biol. 2013 Oct 16. PMID: 24140982


* Denotes co-senior authorship

**JOURNAL ARTICLES (Invited/Published)**


**ABSTRACT PUBLICATIONS**


34. Jackson WM, Aragon AB, Koehler SM, Giuliani JR, Tuan RS, Nesti LJ. Osteogenic progenitor cells derived from blast-injured muscle tissue contain characteristic markers of mesenchymal stem cells. Soc Mil Ortho Surgeons, 2007. Vail, CO.


47. Shanti RB, Li WJ, Nesti LJ, Tuan RS. 2005 A Three-Dimensional Nanofibrous Scaffold for Skeletal Muscle Tissue Engineering Using Human Bone Marrow
Derived Mesenchymal Stem Cells National Institute of Arthritis and Musculoskeletal and Skin Diseases Retreat.


56. Nesti LJ, McCann TM, Tuan RS, Hoek 2000 Ethanol Inhibits TGF-β1Induced Intracellular Calcium Signal in Primary Human Osteoblasts. Sigma Xi, Thomas Jefferson University.


PODIUM PAPER PRESENTATIONS


Orthopaedic Association, April 2013, Baltimore MD *Recognized for 1st place Resident Research Award


INVITED LECTURES


BOOK CHAPTERS


Professional Society Activities

11. Chair, ASSH Research Management Committee 2014-Present.
12. Scientific Reviewer, Congressionally Directed Medical Research Programs, 2010- Present.
13. Scientific Reviewer, Armed Forces Institute of Regenerative Medicine II. Fall 2012.
14. Manuscript Reviewer PLOS One 2014-Present

USUHS Activities

1. 27 March 2005, Orthopaedic Orientation Class.
2. 2003-2008, Orthopaedic Pearls Class (provided to 3rd and 4th year medical students during their Orthopaedic rotations)
3. April 2007 – Present, Mentor Orthopaedic Research Lab
5. Co-Director USUHS Microvascular Surgery Course 2012-Present.
6. Space Committee Member 2014-Present

PATENTS


Previous, Current, and Pending Support

**Previous Support**

**PI:** Dr. Leon Nesti  
**Title:** Mechanism of in the Military Amputee Population  
**Time Commitment:**  
**Supporting Agency:** Military Amputee Research Program, Walter Reed Army Medical Center  
**Funding Agency's Procuring Contracting/Grants Officer:**  
**Performance Period:** 2006 - 2008  
**Level of Funding:** $600,000  
**Project Goal:**  
**Role:** PI

**PI:** Dr. Leon Nesti  
**Title:** A Novel Biomimetic Allograft Bone Powder-Nanofibrous Scaffold Bone Substitute  
**Time Commitment:**  
**Supporting Agency:** Musculoskeletal Transplant Foundation  
**Funding Agency's Procuring Contracting/Grants Officer:**  
**Performance Period:** 2007-2008  
**Level of Funding:** $120,000  
**Project Goal:**  
**Role:** PI

**PI:** Dr. Leon Nesti  
**Title:** Evaluation of a Nanoscale Peripheral Nerve Conduit  
**Time Commitment:**  
**Supporting Agency:** Comprehensive Neuroscience Program  
**Funding Agency's Procuring Contracting/Grants Officer:**  
**Performance Period:** 2008 - 2010  
**Level of Funding:** $300,000  
**Project Goal:**  
**Role:** PI

**PI:** Dr. Leon Nesti  
**Title:** Small Molecule Therapy in the Prevention of Heterotopic Ossification  
**Time Commitment:** 0.6 calendar months  
**Supporting Agency:** DRMRP  
**Funding Agency's Procuring Contracting/Grants Officer:**  
**Performance Period:** 2009 - 2010  
**Level of Funding:** $150,000  
**Project Goal:** The aim of this project is to test the hypothesis that treatment with Dorsomorphin will make up for failures in endogenous BMP signaling attenuation mechanisms that occur in the traumatically injured muscle and lead to heterotopic ossification.
Role: PI

PI: Dr. Leon Nesti
Title: Virtual Stress Test of Healing Fractures
Time Commitment:
Supporting Agency: USAMRRA

Funding Agency's Procuring Contracting/Grants Officer:
Performance Period: 2010-2014
Level of Funding: $110,000
Project Goal:
Role: PI

PI: Dr. Leon Nesti
Title: Stem Cell Based Neurotrophic Enhancement of an Aligned Nanofiber Scaffold for Nerve Repair
Time Commitment: 1.2 calendar months
Supporting Agency: USAMRAA

Funding Agency's Procuring Contracting/Grants Officer:
Thomas Scofield
Vice President Business Development
Henry M. Jackson Foundation
1401 Rockville Pike, Suite 600
Rockville, MD 20852-1402
(301) 294-1243
tscofield@hjf.org
Performance Period: 2011-2014
Level of Funding: $313,643
Project Goal: The goal of this project is to test the hypothesis that mesenchymal progenitor cells derived from traumatized muscle and seeded within a biodegradable scaffold consisting of aligned nanofibers are capable of providing neurotrophic enhancement of nerve regeneration by generating a biochemical bridge that promotes axonal growth and migration of cells that promote regeneration.
Role: PI

Current Support

PI:
Title: Mechanisms of Heterotopic Ossification.
Time Commitment:
Supporting Agency: NIH

Funding Agency's Procuring Contracting/Grants Officer:
Performance Period: 2009 - Present
Level of Funding:
Project Goal:
Role:

PI: Dr. Leon Nesti
Title: Mesenchymal Progenitor Cell Therapy in the Prevention of Tissue Fibrosis
Time Commitment: 2 calendar months
Supporting Agency: DMRDP

Funding Agency's Procuring Contracting/Grants Officer:
Robyn Strachan
Budget Officer
PI: Dr. Leon Nesti
Title: Early Identification of Molecular Predictors of Heterotopic Ossification following Extremity Blast Injury: Animal Model Correlation with Human Disease
Time Commitment: 2013 - 2016
Level of Funding: $450,000
Project Goal: The proposed clinical trial will establish the effectiveness of a UBMECM scaffold for the restoration of functional skeletal muscle tissue, including the restoration of blood supply and innervation. Successful completion of our objectives would provide a regenerative alternative to the current standard of care for extremity VML and restore quality of life to injured war fighters. We hypothesize that subjects who receive the UBM-ECM scaffold in the acute and subacute post-injury periods will have significant new muscle growth and improvements in strength in the treated extremity.
List of Specific Aims:
Specific Aim 1: To induce the de novo formation of at least 25% of the missing muscle tissue using UBM-ECM.
Specific Aim 2: To restore at least 25% of the function of the involved muscle group.
Role: Co-Principal Investigator

PI: Dr. Leon Nesti
Title: Dermal Coverage of Traumatic War Wounds
Time Commitment: 1.2 calendar months
Supporting Agency: CDMRP
Name and Address of Funding Agency’s Procuring Contracting/Grants Officer: Sandra Rosario
U.S. Army Medical Research Acquisition Activity Grant Specialist - Gold Team
843 Chandler Street
Fort Detrick, MD 21740
Performance Period: 10/31/2012-10/30/2016
Funding: $1,414,865
Goal: The goal of the study described herein is to determine the effectiveness of the use of the ReCell device over a widened STSG mesh in combination with INTEGRA will improve upon the current standard of care.

List of Specific Aims:

- Specific Aim 1: Assess the preliminary effectiveness of ReCell treatment of full-thickness wounds treated with INTEGRA MBWM compared to a control site.
- Specific Aim 2: Assess the long-term effectiveness of ReCell treatment of full-thickness wounds treated with INTEGRA MBWM compared to a control site.
- Specific Aim 3: Evaluate safety of ReCell treatment of full-thickness wounds treated with Integra MBWM compared to control site.

Role: Principal Investigator
Scientific/Budgetary Overlap: None

Pending Support
PI: Dr. Leon Nesti
Title: Clinical Evaluation of Decellularized Nerve Allograft with Autologous Bone Marrow Stem Cells to Improve Peripheral Nerve Repair and Functional Outcomes
Time Commitment:
Supporting Agency: CDMRP
Funding Agency's Procuring Contracting/Grants Officer:
Performance Period: 2015 - 2018
Level of Funding: $2,500,000
Project Goal:
Role: PI