

# LSU Musculoskeletal Research Consortium

**LSU**

LOUISIANA STATE UNIVERSITY

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College, ALL RIGHTS RESERVED

# Musculoskeletal Scientific Research Consortium (MSRC) Mission Statement

Merge scientific knowledge and clinical experience of faculty from three schools within the Louisiana State University system



Facilitate academic and industrial investigations  
Promote multi-disciplinary collaborations to support all stages of research, technologies, and capability platforms



In-depth collaboration and translational research  
*In vitro* and *In vivo* animal models  
Pre-clinical (GLP) and clinical trials  
All aspects of musculoskeletal treatments, devices, and drug delivery systems

# Participants

- Dr Dasa- LSUHSC Orthopedics
- Dr Lopez- LECOR/Orthopaedics/Regeneration
- Dr Murphy- Mechanical Engineering
- Dr Hayes- Bio-engineering/Materials
- Dr Gimble- Tissue Regeneration/PBRC
- Dr Hobden- Microbiology & Immunology
- Dr Jacob- Research Development

**LSU**

**LSU COLLEGE OF  
ENGINEERING**

**SCHOOL OF  
VETERINARY  
MEDICINE**



**LSU Health New Orleans**

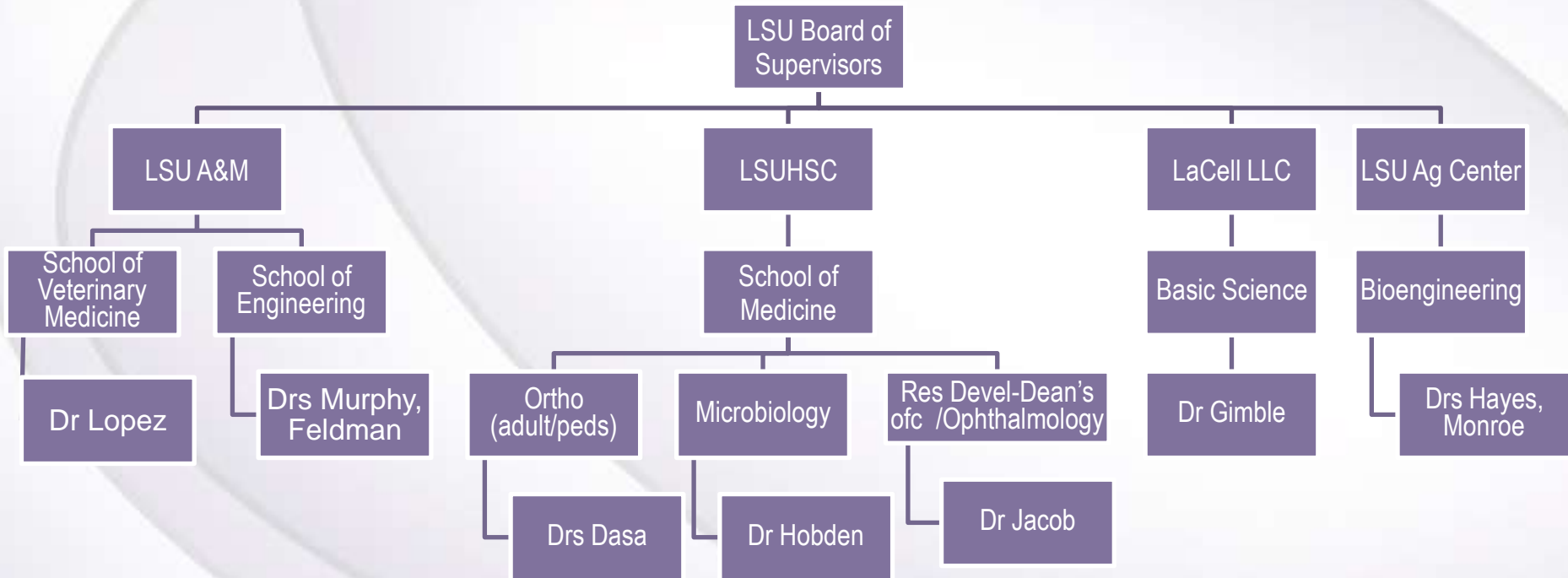
**LaCell LLC**

**LSU**  
LOUISIANA STATE UNIVERSITY

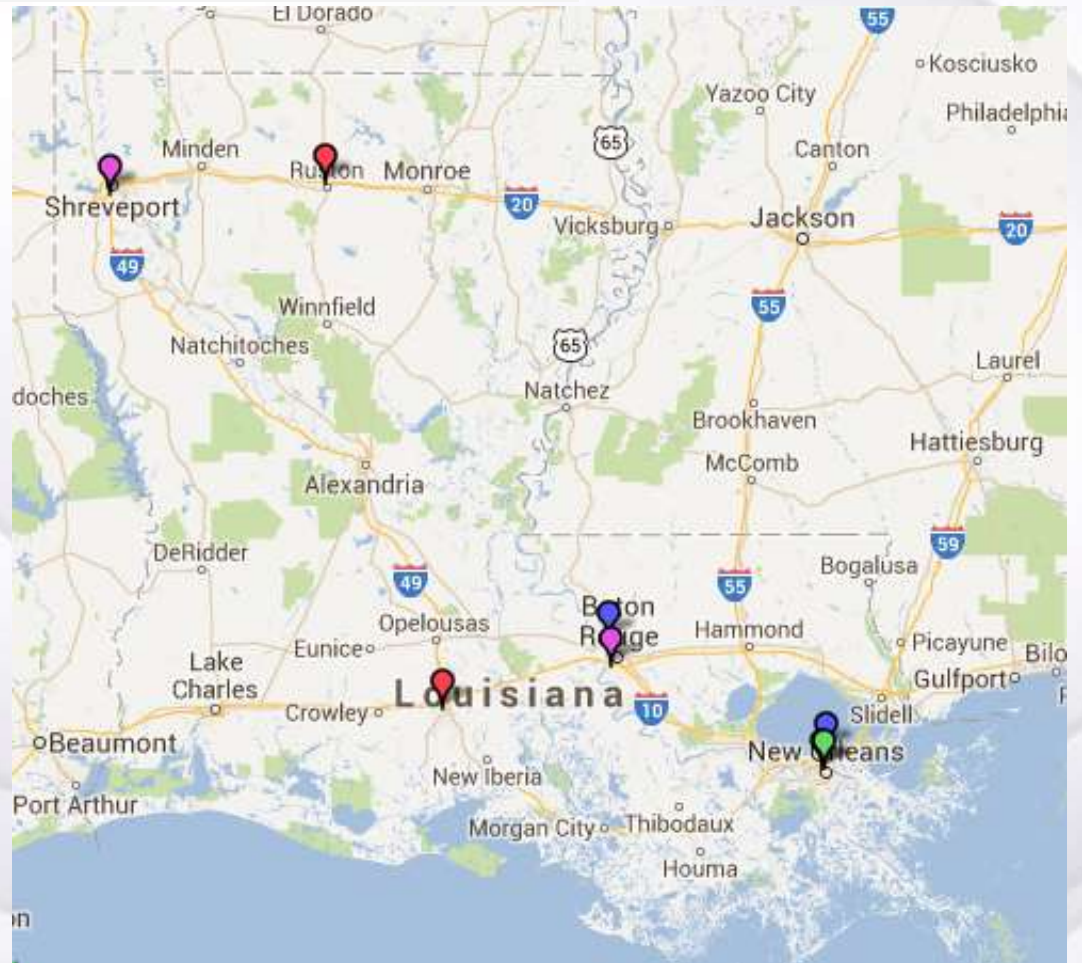
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**LSU**  
**AgCenter**  
Research & Extension

# Louisiana State University System



# Louisiana Access Grid Network



# Recent Manuscripts

Medical Devices: Evidence and Research

Dovepress

Open Access Full Text Article

ORIGINAL RESEARCH

## Novel anterior cruciate ligament graft fixation device reduces slippage

This article was published in the following Dove Press journal:  
Medical Devices: Evidence and Research  
13 May 2012  
Number of times this article has been viewed

Mandi J Lopez<sup>1</sup>  
Allan Berne<sup>2</sup>  
W Todd Monroe<sup>1</sup>  
Prakash Bommalu<sup>1</sup>  
Laura Kelly<sup>1</sup>  
Nan Zhang<sup>1</sup>

**Abstract:** Clinically significant laxity occurs in 10%–30% of knees after anterior cruciate ligament reconstruction. Graft slippage and tension loss at the hamstring graft tibial fixation site during and after reconstruction surgery contribute to postoperative joint laxity and are detrimental to long-term knee stability and graft properties. Limiting graft slippage will reduce associated complications. We sought to compare the *in vitro* mechanical properties and *in vivo* joint stabilization, postoperative limb use, and graft incorporation of the novel GraftGrasp<sup>®</sup>

JOURNAL OF TISSUE ENGINEERING AND REGENERATIVE MEDICINE

RESEARCH ARTICLE

*J Tissue Eng Regen Med* (2012)

Published online in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/term.1565

## Comparison of infrapatellar and subcutaneous adipose tissue stromal vascular fraction and stromal/stem cells in osteoarthritic subjects

Pedro Pires de Carvalho<sup>1,2,3\*</sup>, Katie M. Hamel<sup>1\*</sup>, Robert Duarte<sup>4</sup>, Andrew G. S. King<sup>2</sup>, Masudul Haque<sup>5</sup>, Marilyn A. Dietrich<sup>5</sup>, Xiyang Wu<sup>1</sup>, Forum Shah<sup>1</sup>, David Burk<sup>1</sup>, Rui L. Reis<sup>2,3</sup>, Jennifer Rood<sup>1</sup>, Ping Zhang<sup>4,5</sup>, Mandi Lopez<sup>4,5</sup>, Jeffrey M. Gimble<sup>1,4\*</sup> and Vinod Dasa<sup>4</sup>

<sup>1</sup>Pennington Biomedical Research Center, 6400 Perkins Road, Baton Rouge, LA, USA

<sup>2</sup>3B5 Research Group, Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, Avepark, Guimarães, Portugal

<sup>3</sup>ICVS/3B5 PT Government Associated Laboratory, Braga/Guimarães, Portugal

<sup>4</sup>Louisiana State University Health Sciences Center and Musculoskeletal Research Consortium, New Orleans, LA, USA

<sup>5</sup>Louisiana State University School of Veterinary Medicine, Baton Rouge, LA, USA

\*Michigan State University, Department of Surgery, East Lansing, MI, USA

## Human adipose-derived stem cells and three-dimensional scaffold constructs: A review of the biomaterials and models currently used for bone regeneration

Andrea S. Zanetti,<sup>1</sup> Cristina Sabliov,<sup>1</sup> Jeffrey M. Gimble,<sup>2</sup> Daniel J. Hayes<sup>1</sup>

<sup>1</sup>Department of Biological and Agricultural Engineering, Louisiana State University and LSU AgCenter, Louisiana

<sup>2</sup>Pennington Biomedical Research Center, Stem Cell Biology Lab, Louisiana State University, Louisiana

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Published online 21 September 2012 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/jbm.b.32817

## Antimicrobial biocompatible bioscaffolds for orthopaedic implants

Ammar T. Qureshi<sup>1</sup>, Lekeith Terrell<sup>1</sup>, W. Todd Monroe<sup>1</sup>, Vinod Dasa<sup>2</sup>, Marlene E. Janes<sup>3</sup>, Jeffrey M. Gimble<sup>4</sup>, Daniel J. Hayes<sup>1,\*</sup>

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Issue



Journal of Tissue Engineering and Regenerative Medicine

Early View (Online Version of Record published before inclusion in an issue)

The Veterinary Journal 101 (2012) 231–239



Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: [www.elsevier.com/locate/tvj](http://www.elsevier.com/locate/tvj)



## In vitro expansion and differentiation of fresh and revitalized adult canine bone marrow-derived and adipose tissue-derived stromal cells

Nakia D. Spencer<sup>a</sup>, Raymond Chun<sup>a</sup>, Martin A. Vidal<sup>a,\*</sup>, Jeffrey M. Gimble<sup>b</sup>, Mandi J. Lopez<sup>a\*</sup>

<sup>a</sup>Laboratory for Equine and Comparative Orthopedic Research, Louisiana State University, School of Veterinary Medicine, Skip Berman Drive, Baton Rouge, LA 70803, USA

<sup>b</sup>Stem Cell Biology Laboratory, Pennington Biomedical Research Center, Baton Rouge, LA 70803, USA

## Biocompatible/Bioabsorbable Silver Nanocomposite Coatings

Ammar T. Qureshi,<sup>1</sup> W. Todd Monroe,<sup>1</sup> Mandi J. Lopez,<sup>2</sup> Marlene E. Janes,<sup>3</sup> Vinod Dasa,<sup>4</sup> Sunggook Park,<sup>5</sup> Alborz Amirsadeghi,<sup>5</sup> Daniel J. Hayes<sup>1</sup>

<sup>1</sup>Department of Biological and Agricultural Engineering, Louisiana State University and Agricultural Center, Baton Rouge, Louisiana 70803

<sup>2</sup>Department of Veterinary Clinical Sciences, Louisiana State University, Baton Rouge, Louisiana 70803

<sup>3</sup>Department of Food Science, Louisiana State University Agricultural Center, Baton Rouge, Louisiana 70803

<sup>4</sup>Department of Orthopedics, Louisiana State University Health Science Center, New Orleans, Louisiana 70115

<sup>5</sup>Department of Mechanical Engineering, Louisiana State University, Baton Rouge, Louisiana 70803

Received 11 June 2010; accepted 28 September 2010

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# Research Internships 2011

## **Sean Michael Rider – MJ Lopez**

“Chronic Alcoholism Inhibits Adult Stromal Cell Osteogenesis In Vivo Through Alterations in Cytokine Ratios”

2<sup>nd</sup> Place LSU SVM Phi Zeta Research Day

## **Trevor Stubbs – D Hayes**

“Composite Scaffold for Bone Regeneration with Osteogenic and Antimicrobial Properties”

3<sup>rd</sup> Place LSU SVM Phi Zeta Research Day

## **Brandon Hicks – J Hobden**

“Killing *Staphylococcus epidermidis* Biofilms on Prosthetic Joint Materials with the Antiseptic Agents Povidone-iodine and Chlorhexidine di-gluconate”

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# Research Internships 2012

## **Sarah Frischhertz MJ Lopez**

“Primate Femur Histomorphometry and Gene Expression: Effects of Chronic Alcohol Abuse on Bone”

1<sup>st</sup> Place LSU SVM Phi Zeta Research Day, 2nd Place LSU HSC Student Research Day

## **Raeanna Simcoe MJ Lopez**

“Localization and Enumeration of Progenitor Cell Surface Markers and Primordial Keratins in the Laminitic Equine Hoof”

1<sup>st</sup> Place LSU SVM Phi Zeta Research Day

## **Mason Adams – M. Feldman**

“Design of Methods and Fabrication of MEMS Endoscope”

# Research Internships 2012

## **Jake Trahan III – M. Murphy**

“A Rapid Processor for Methicillin-Resistant *Staphylococcus aureus* (MRSA) Identification in the Operating Room”

## **Timothy Machen – D. Hayes**

“Hemolytic Properties of the Anti-Bacterial Compounds CSA-124 and CSA-124 Bound to Silver Nanoparticles”

# Industry Visits



stryker®



smith&nephew



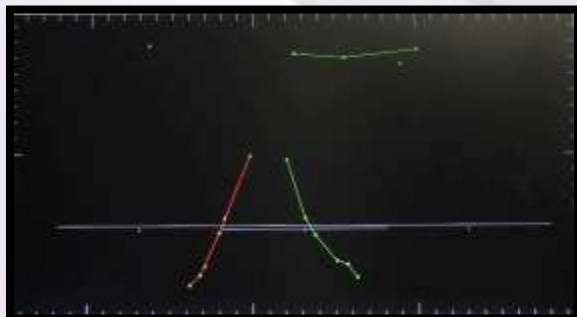
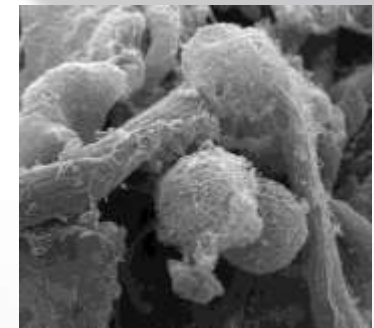
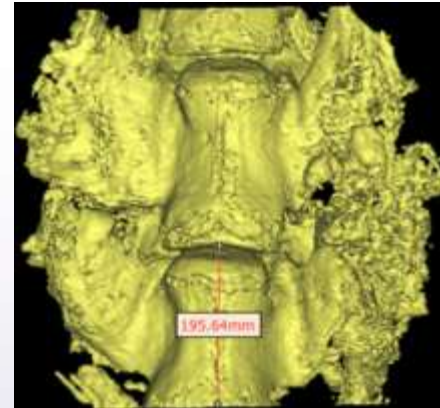
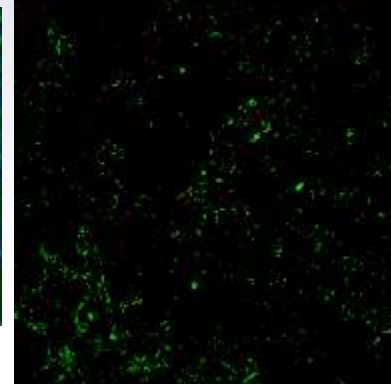
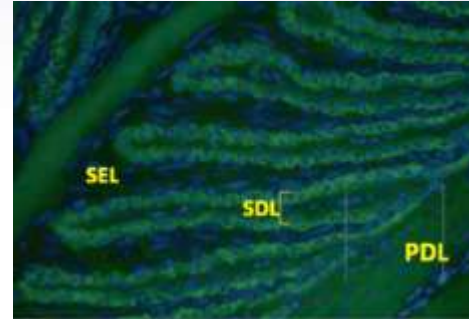
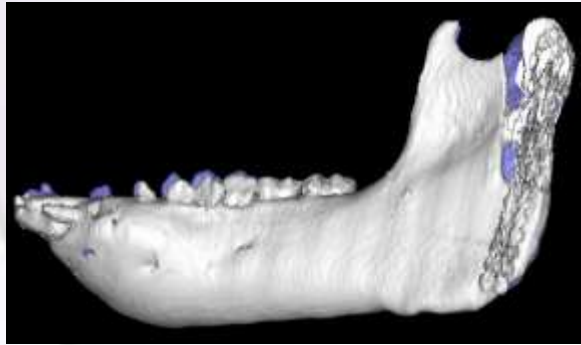
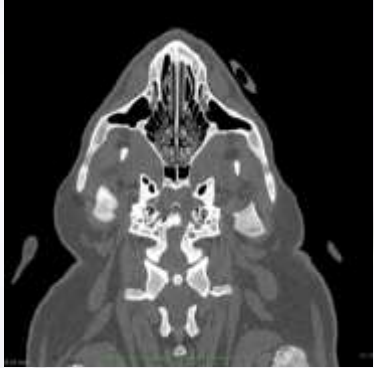
BioSkin®



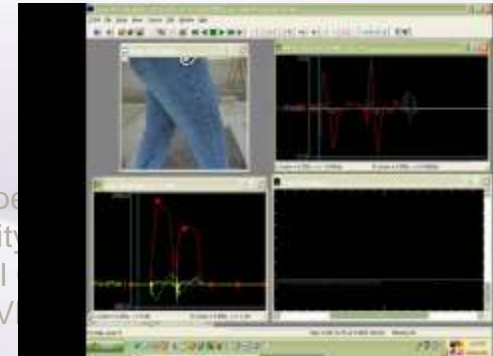
myoscience

# Mandi J. Lopez, DVM, MS, PhD

Diplomate, American College of Veterinary Surgeons  
Laboratory for Equine and Comparative Orthopedic Research



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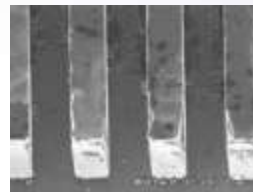
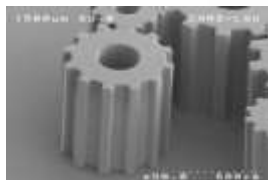
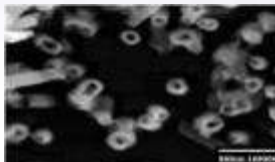
# Mixed Scale Fabrication Resources

**Forming Patterns**  
 $10^{-8} \text{ m} \Rightarrow 10^{-1} \text{ m}$

UV lithography



**Filling Patterns (Metals)**  
 $10^{-8} \text{ m} \Rightarrow 10^{-1} \text{ m}$



X-ray lithography



Excimer laser

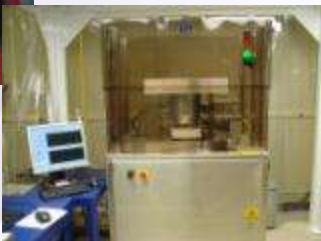
**Replicating Patterns**  
 $10^{-8} \text{ m} \Rightarrow 10^{-1} \text{ m}$



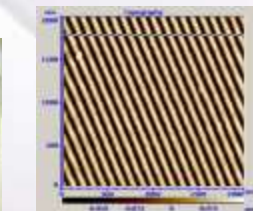
Battenfeld injection molding



Micro-milling



Obducat  
 nano-imprinting



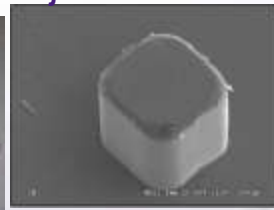
50 nm grating



Jenoptik HEX 02



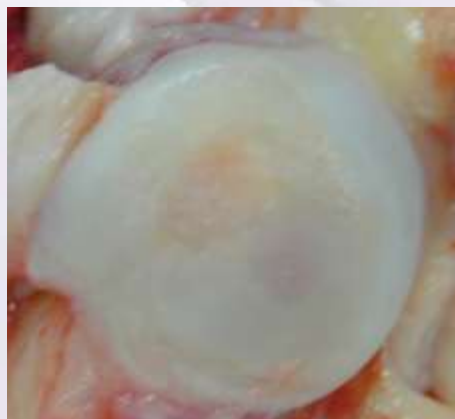
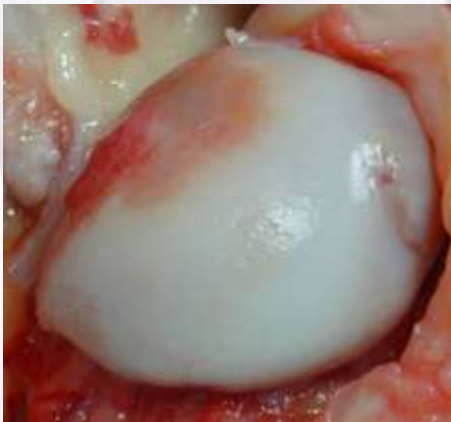
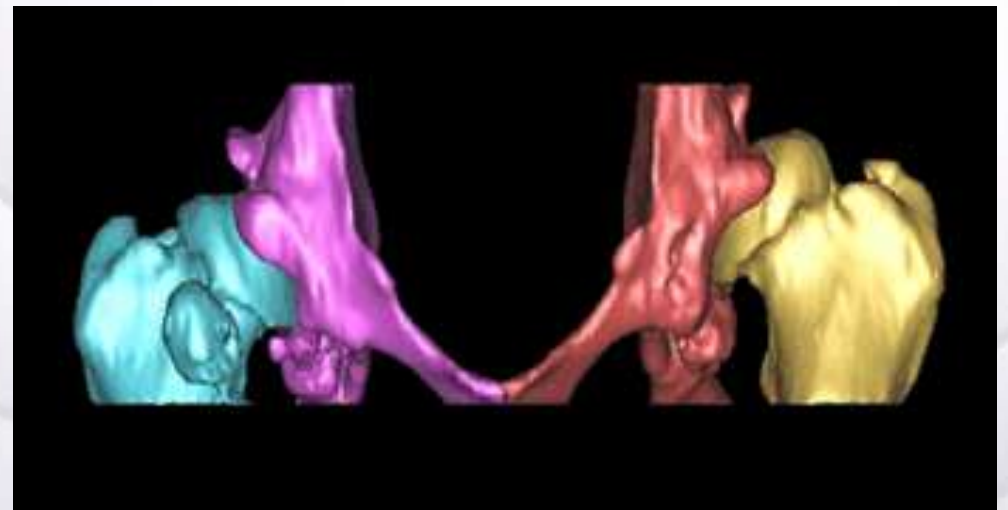
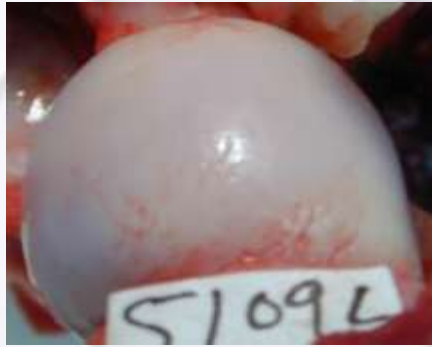
Double-sided Injection molded  
 hot embossing



Cube



# Canine AVN Model





# Michael C. Murphy, PhD

Roy O. Martin Jr. Lumber Company Professor  
PhD, Mechanical Engineering (MIT)



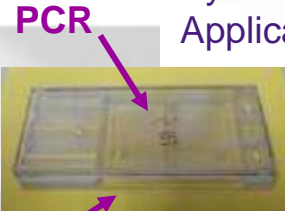
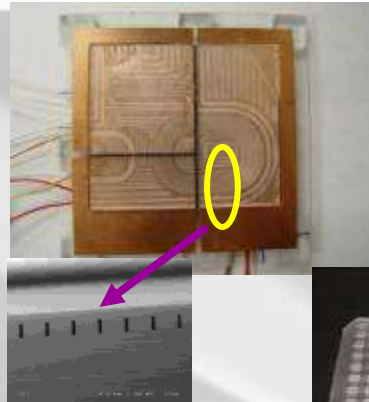
## Microsystems

Design  
Fabrication  
HARMS  
Assembly

## Biomechanics

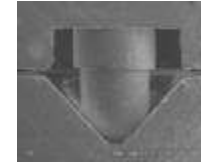
Measurement of  
Knee Kinematics  
Displacement  
Workspaces  
Velocity  
Workspaces

## Devices



★ Modular Micro/Nano-Systems for Biomedical Applications

## Assembly Technology



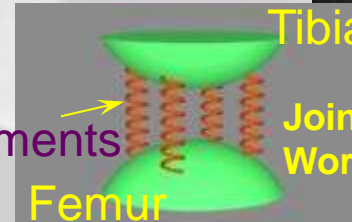
## Endoscopic Instruments Systems

## Modules

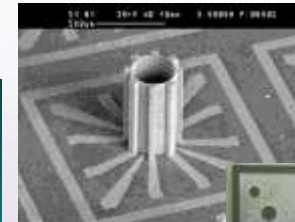
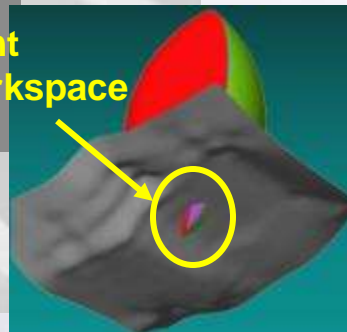
## Multi-well Platforms



★ Robust Sensors and Actuators



★ Understanding the Kinematics and Control of the Knee



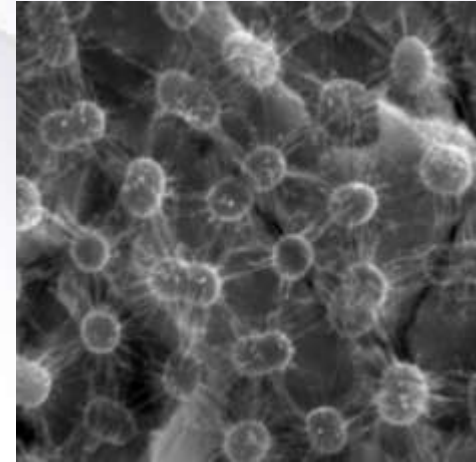
## microGyro

## microGC



# Jeff Hobden, PhD

- Fully equipped bio-safety Level 2+ lab
- Capable of working with most pathogens, including anaerobes
- Extensive collection of ATCC strains and clinical isolates
- Equipped for most molecular biology techniques, including PCR and RT-PCR
- light microscopy, laser confocal microscopy and scanning electron microscopy capable





# Modular Microfluidics for Pathogen Identification

## Rationale

- **Build more complex systems**
  - 'Stack' modules to form a more capable instruments
  - Design task specific instruments
  - Scalable => single use and high throughput formats use similar technology
- **Process complexity for individual modules the same**
  - Processes/materials can be optimized at each level
  - Molding can reduce the cost of modules/components
- **LSU is a leader in developing technology for polymer, modular microfluidic systems**

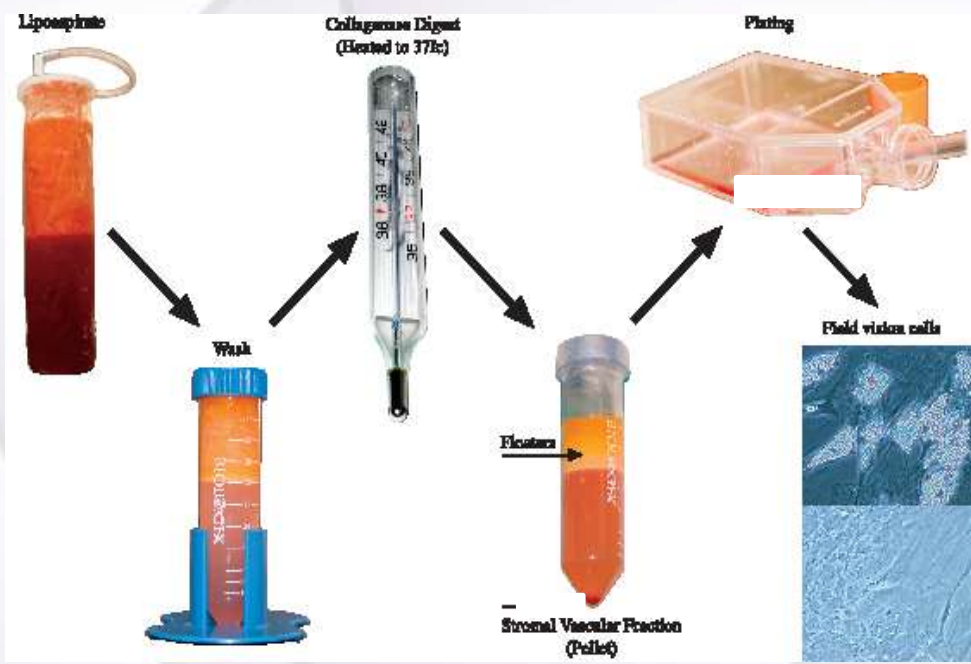


## Motivation

- Fast, definitive detection of MRSA and other pathogens at point of care
- Avoid safety issues while minimizing patient and staff exposure
- Eliminate unnecessary preventive treatment with antibiotics

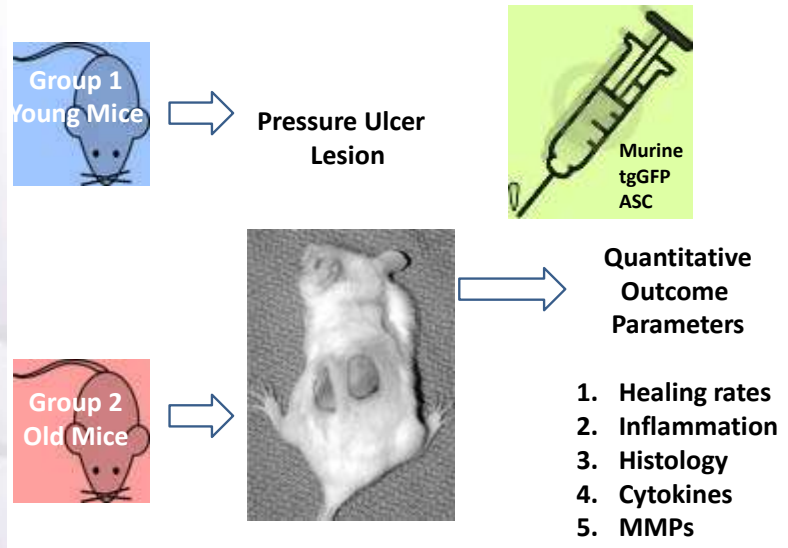
# Jeff Gimble, MD, PhD

Cofounder, LaCell LLC

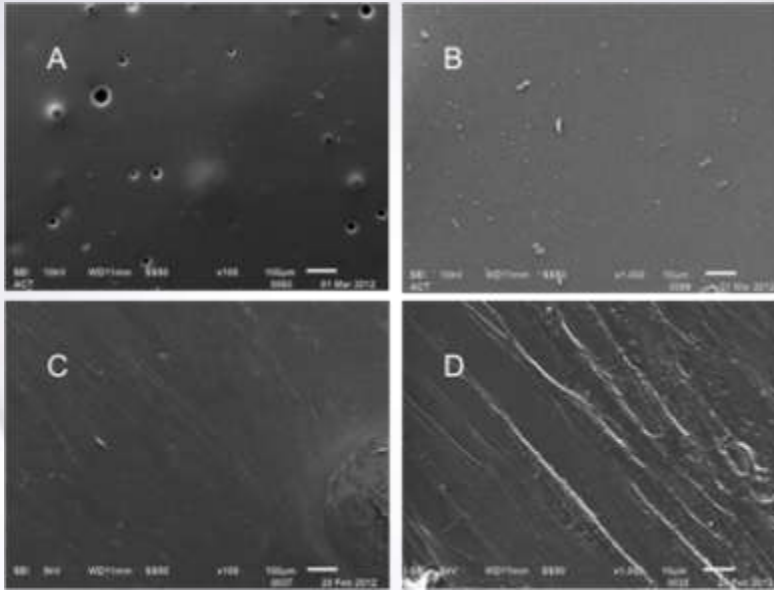


## Cell Isolation From Liposuction Adipose Tissue

## Application of ASC to Chronic Wounds

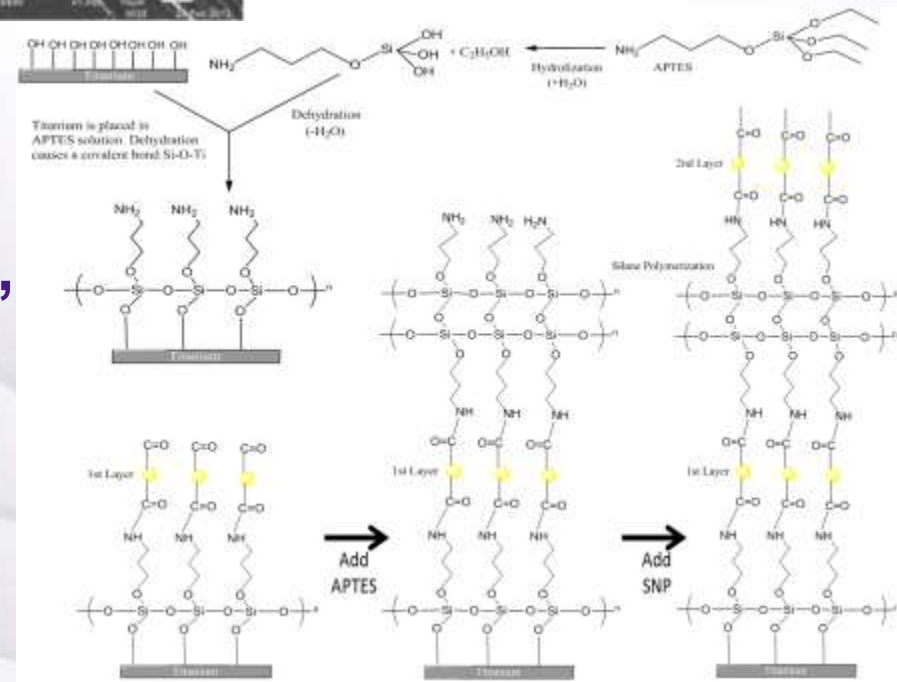


# Daniel Hayes, PhD

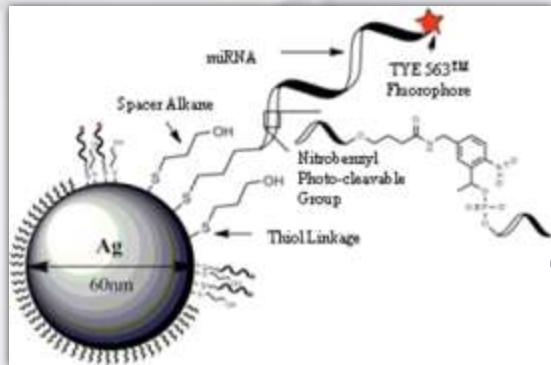


## Thiol Acrylate Nanocomposite for Critical Size Bone Defect Repair

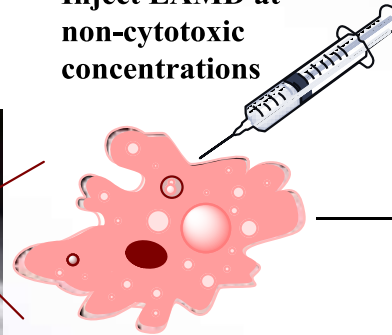
Implant Coatings – Antimicrobial, Biological Incorporation, Accelerated Healing



# Light Activated miRNA Delivery System

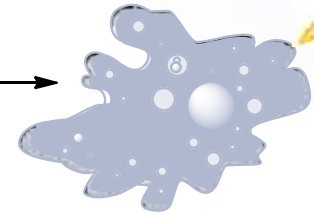


Inject LAMD at non-cytotoxic concentrations



Critical size defect

UV laser selectively moved across wound site

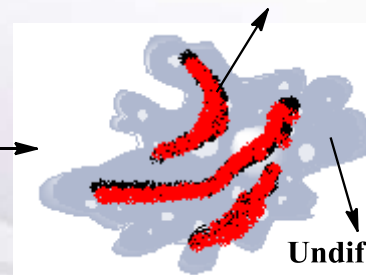


Wound site with LAMD

Laser spatially cleaves miRNA from LAMD



Spatial differentiation of hASCs



Undifferentiated hASC with LAMD

- Delivery systems provides spatial and temporal control
- Potential to improve outcomes in surgical reconstruction and regenerative medicine by modulating wound healing and tissue repair processes

# LSU Musculoskeletal Research Consortium

Dasa, Lopez,  
Gimble, Hayes,  
Hobden, Jacob,  
Murphy

Clinical Trials

Preclinical  
Testing (GLP)

Cell, Tissue Testing

Surgery  
Engineering  
Animal Models  
Cell Physiology  
Biocompatibility  
Implants  
Polymers

Nano-, Microfabrication  
Bioactive Implant Coatings

Microbial Testing/Detection

Intra-cellular, joint and  
whole body assessments

Research Experience