	Harvard Medical School/Harvard School of Dental Medicine Format for the Curriculum Vitae
Date Prepared:	December 21, 2012
Name:	Martha Meaney Murray
Office Address:	Children's Hospital, Boston Department of Orthopaedic Surgery 300 Longwood Avenue, Hunnewell 2 Boston, MA 02115
Work Phone:	617-355-7132
Work Email:	martha.murray@childrens.harvard.edu
Work FAX:	617-730-0459
Place of Birth:	Boston, MA

# **Education**

1987	BME	Mechanical Engineering	University of Delaware
1990	MS	Materials Science and Engineering	Stanford University
1994	MD	Medicine	University of Pennsylvania

# **Postdoctoral Training**

1994-95	Intern	General Surgery	Mass. General Hospital
1995-99	Resident	Orthopaedic Surgery	Harvard Combined
1999-2000	Research Fellow	Orthopaedic Surgery	Brigham and Women's Hospital
2001-2002	Fellow	Pediatric and Adult Sports Medicine	Children's Hospital Boston
2002-2003	Fellow	Pediatric Orthopaedic Surgery	Children's Hospital Boston

# **Faculty Academic Appointments**

2001-05	Instructor	Orthopaedic Surgery	Harvard Medical School
2006-10	Assistant Professor	Orthopaedic Surgery	Harvard Medical School
2010-	Associate Professor	Orthopaedic Surgery	Harvard Medical School

# Appointments at Hospitals/Affiliated Institutions

1999-07	Orthopaedic Surgeon	Orthopaedic Surgery	Brigham and Women's
			Hospital
2002-	Staff Physician	Orthopaedic Surgery	Children's Hospital Boston

2003-	Courtesy Privileges	Orthopaedic Surgery

Beth Israel Deaconess Medical Center

## **Other Professional Positions**

2008-2011	Scientific Founder	Connective Orthopaedics
2008-10	Scientific Advisory Board Member	Connective Orthopaedics
<u>Major Adn</u>	ninistrative Leadership Positions	
Local		
2004-	Director	Children's Sports Medicine Foundation
		Board
2008-	Site Miner, CIMIT	Children's Hospital Boston

Regional

#### National and International

## **Committee Service**

Local		
2002-04	Residency Selection Committee	Harvard Combined Orthopaedic Residency Program
	2002-2004	Faculty Selector
2011-	Fellowship Selection Committee	Children's Hospital Boston Sports Medicine Fellowship Program
	2011	Faculty Selector
2012	Clinical Research Space Committee	Boston Children's Hospital Committee Member
2012	Colleague-2-Colleague Ideation Team (C2Ci)	Boston Children's Hospital Faculty Mentor
Regional		
2011	WOWster Program	Governor's Science, Technology, Engineering and Math Advisory Council
	2011-2012	Mentor
National and In	ternational	
2007	Advisory Board, Dept of Mech Engineering	University of Delaware
	2007-2008	External Advisory Board Member
2007	NIH Advisory Groups	NIH
	2007	Musculoskeletal Trauma Focus Group Member
	2007	Functional Tissue Engineering – Invited Group Leader for Ligament
	2008	Stimulating and Commercializing Tissue Engineering and Regenerative Medicine

#### 2008

	1/2007
2007	Conference on Functional Tissue
	Engineering
	2007
2008-	Research Committee
	2008-present
2010-	Data and Safety Monitoring Board
2010-2012	Gordon Research Conference
	2010, 2012
2013-2016	Advisory Council, NIAMS
	2013-

### **Professional Societies**

American Academy of Orthopaedic		
Surgeons		
2006	Active Fellow	
2008, 2009, 2010, 2011	Instructional Course Lecturer	
Ruth Jackson Orthopaedic Society		
Orthopaedic Research Society	~	
2003-2011	Session Moderator	
2004, 2007, 2009, 2012	Abstract Reviewer	
2009	Mentoring Program (Mentor)	
2009-2011	Nominating Committee	
2011	Invited Session Moderator	
FORUM Study Group	Founding Member	
International Society for Tendons and		
Ligaments		
2003	Session Moderator	
2007	Abstract Reviewer	
2007	Program Committee	
2008	Invited Keynote Lecture	
2011	Invited Session Moderator	
Pediatric Orthopaedic Society of North		
America (POSNA)		
2010	Invited Lecturer, Specialty Day	
ACL Study Group		
2004	Invited Lecturer	
2006-2012	Invited Symposium Leader	
2006-2008	Traveling Scientist	
2008-2012	Invited Keynote Lecturer	
2008-	Scientific Committee Chair	
American Orthopaedic Society for Sports		
	American Academy of Orthopaedic Surgeons 2006 2008, 2009, 2010, 2011 Ruth Jackson Orthopaedic Society Orthopaedic Research Society 2003-2011 2004, 2007, 2009, 2012 2009 2009-2011 2011 FORUM Study Group International Society for Tendons and Ligaments 2003 2007 2007 2007 2008 2011 Pediatric Orthopaedic Society of North America (POSNA) 2010 ACL Study Group 2004 2006-2012 2006-2012 2008- American Orthopaedic Society for Sports	

Translational Models for Musculoskeletal

Invited Group Leader - Ligament Section

NIAMS, Single- vs Double- Bundle ACL

Reconstruction, Univ of Pittsburgh Musculoskeletal Tissue Engineering Invited Session Moderator

Tissue Engineering Invited Member

ACL Study Group

Invited Member

Chairman

NIH

NIH

	Medicine 2005 2009	Invited Symposium Speaker Invited Award Lecturer
2008-	Tissue Engineering and Regenerative Medicine International SocietyAbstract Reviewer2008, 2010Abstract Reviewer2008Invited Session Chair2010Mambarshin Committee N	

### **Grant Review Activities**

2000	Research Funding and Policy Division 2000	Health Research Board, Ireland Grant Reviewer
2007-2008	Musculoskeletal Tissue Engineering (MTE) Study Section	NIH
	2007-2008	Ad hoc Member
	2009-2012	Permanent Member
2008	Special Emphasis Panel ZRG1 MOSS- L(03)	NIH
	6/2008	Ad Hoc Member
2008	Skeletal Biology Structure and Regeneration	NIH
	2008	Ad Hoc Member
2009	Clinical Science Investigations Program	Center for Innovative and Minimally Invasive Technology (CIMIT)
	2009, 2010	Grant Reviewer
2011	Grant Review Committee 2011	Musculoskeletal Transplant Foundation Grant Reviewer

### **Editorial Activities**

Journal of Orthopaedic Research The American Journal of Sports Medicine Journal of Bone and Joint Research Clinical Orthopaedics and Related Research Tissue Engineering Journal of Biomedical Materials and Research Part A Wound Repair and Regeneration Veterinary Surgery Arthritis and Rheumatism The Journal of Musculoskeletal Medicine Journal of Bone and Joint Surgery Knee Surgery, Sports Traumatology, Arthroscopy

## **Other Editorial Roles**

## **Honors and Prizes**

1987 Faculty Award

University of Delaware

Scholarly Achievement

		Mechanical Engineering Dept	
1987	First Place	University of Delaware Mechanical Engineering Dept	Senior Design Project
1994	AOA Election	Alpha Omega Alpha Society	Medical School Academics
2000	CH Herndon Award	Musculoskeletal Transplant Foundation	Resident Research Award
2001	50 <sup>th</sup> Anniversary Scholar in Medicine	Harvard Medical School	Young Faculty Research Award
2001, 2009	Cabaud Award	American Orthopaedic Society for Sports Medicine (AOSSM)	Basic Science Research in Sports Medicine
2002	Kilfoyle Award	New England Orthopaedic Society	Orthopaedic Research
2004	Best Poster Prize	German Academy Orthopaedic Surgeons	ACL Research (Vavken)
2006-08	Traveling Scientist	ACL Study Group	ACL Research
2008	Distinguished Career Award	University of Delaware, College of Engineering	
2009	Best Paper Prize	German Association of Arthroscopy	ACL Research (Vavken)
2010	Charlton Poster Prize	Tufts University School of Medicine	ACL Research (Yoshida)
2013	Kappa Delta Award	American Academy of Orthopaedic Surgeons (AAOS)	ACL Research
2013	Cabaud Memorial Award	American Orthopaedic Society for Sports Medicine	Orthopaedic Sports Medicine Research

# **Report of Funded and Unfunded Projects**

# **Funding Information**

## Past

1999-2002	Scaffold Optimization for Healing of the Ruptured ACL NIH R03 AR 46356 Principal Investigator, \$150K total directs This project involved studying the response of ACL cells in vitro to various scaffolding materials
2000	Growth Factor Optimization of Collagen Production by ACL Cells
	Orthopaedic Research and Education Foundation (OREF) Research Grant
	Principal Investigator, \$15K total directs
	This project involved studying the response of ACL cell collagen production for 4 specific growth factors.
2000-2001	Development of a Tissue Scaffold for Intra-articular Use
	Center for Innovative and Minimally Invasive Technology (CIMIT) Research Grant
	Principal Investigator, \$100K total directs
	The goal of this project was to develop a collagen hydrogel for ACL repair.
2002-2003	Growth Factor Delivery Systems for Stimulation of ACL Healing
	National Football League Medical Charities
	Principal Investigator, \$70K total directs

	This project involved combining growth factors found to stimulate ACL cell production
2004 2000	with a collagen hydrogel carrier as a delivery vehicle.
2004-2009	Enhanced Primary Healing of the ACL
	NIH KU2 AKU49340 Dringingl Investigator \$272K total directs \$20K total indirects
	This award provided salary support for me to allow me to have protected time to conduct
	my work on ACL healing
2004-2005	Delivery System for Enhanced Primary Renair of the ACL
2001 2005	Center for Innovative and Minimally Invasive Technology (CIMIT) Research Pilot Grant
	Principal Investigator, \$25K total directs
	This project involved designing and developing an arthroscopic delivery device for the
	collagen hydrogel.
2004-2006	Stimulation of Intra-articular Defect Healing
	National Football League Medical Charities
	Principal Investigator, \$81K total directs, \$8K total indirects
	This project involved testing of the collagen-based hydrogel in an in vivo large animal
	model as a pilot study.
2005-2007	Enhanced Arthroscopic Repair of Meniscal Injuries
	Center for Innovative and Minimally Invasive Technology (CIMIT) Research Grant
	Principal Investigator, \$250K directs
	This project involved developing a meniscal tear model for evaluation of the hydrogel
2006 2010	A Novel Mechanism for Intra articular Nonunion
2000-2010	NIH R01 A R052772
	Principal Investigator \$860K total direct costs
	This project involved the study of collagen-platelet hydrogels for ACL healing
2006-2010	Prognosis and Predictors of ACL Reconstruction
2000 2010	NIH R01 AR053684
	Site Principal Investigator, \$10K total direct costs
	This project involved advising and helping to design a large multicenter cohort study of
	ACL reconstruction (the MOON study).
2006-2010	A Biologic Basis for ACL Repair
	NIH R01 AR052809
	Site Principal Investigator, \$475K direct costs,
	This project involved comparing bioenhanced ACL repair and ACL reconstruction in a
0000 0011	large animal model.
2009-2011	Biologically Enhanced Healing of Autograft ACL Reconstruction
	NIH KUI AKU50834-51 Dringingi Investigator \$1,270,000 total directs
	The goals of this study were to determine if collegen platelet composites could enhance
	ACL graft healing as well as primary repair of the ACL at 6 months and 1 year in a large
	animal study.
Current	
2006-2014	The Effect of Age on Functional ACI. Healing
2000-2014	NIH R01 AR054099
	Principal Investigator \$2,685,000 total direct costs \$1,040,000 total indirect costs
	The goal of this project is to define the effect of skeletal maturity on ACL healing and to

determine mechanisms to enhance healing in patients of all ages.

2009-2013 Biologically Enhanced Healing of Autograft ACL Reconstruction NIH R01 AR056834 Principal Investigator, \$1,277,000 total direct costs The goals of this study were to determine how the platelet concentration in a collagenplatelet scaffold would affect ACL graft healing at 3 months after surgery.

**Current Unfunded Projects** 

# **Report of Local Teaching and Training**

<b>Teaching of</b>	Students in Courses	
2000-02	Pathology/Orthopaedic Implants	HMS
	1 <sup>st</sup> year medical students	2 hour class each year
2001-03	Clinical Anatomy of the Knee	HMS
	3 <sup>rd</sup> year medical students	1-2 hour class each year
2003	Advanced Anatomy Course	HMS
	3 <sup>rd</sup> year medical students	1-2 hour class each year
2006-2012	Patient:Doctor II: Musculoskeletal	HMS
	Examination	
	2 <sup>nd</sup> year medical students	2-4 hour class each year
2007	HST 906: Role of Physicians and Scientists	HMS
	in the Business World	
	2 <sup>nd</sup> year medical students	1 hour lecture
2008-2009	HST 020: Musculoskeletal Pathology	HMS
	1 <sup>st</sup> year medical students	1 hour class each year
2011	Pathophysiology of the Musculoskeletal	HMS
	System	
	1 <sup>st</sup> year medical students	1.5 hour lecture

Formal Teaching of Residents, Clinical Fellows and Research Fellows (post-docs)

1998-2003	Review for Orthopaedic Intraining Exam	Mass General Hospital
	30 orthopaedic residents	3 hour lecture
1998-99	Introduction to Orthopaedic Surgery	Mass General Hospital
	Orthopaedic residents and medical students	Three 2 hour lectures
2001	Examination of the Pediatric Knee	University of Massachusetts
	Pediatrics Residents	1 hour lecture
2001-2003	Pathophysiology of Tendon and Ligament	Brigham and Women's Hospital
	Injuries	
	Orthopaedic Residents	1 hour lecture
2001	Evaluation and Treatment of Common	Brigham and Women's Hospital
	Sports Medicine Injuries	
	Primary Care Residents	1 hour lecture
2004, 2011	Biologic Approaches to Tendon and	BWH
	Ligament Injuries	
	Orthopaedic Residents	1 hour lecture each year

2004-2007	New Directions in Sports Medicine	CHB
	Orthopaedic Residents	Two 1 hour lectures each year
2007-2012	Primary Repair of the ACL	CHB – Sports Medicine
	Sports Medicine Fellows	1 hour lecture each year
2008-2012	Evidenced Based ACL Reconstruction	CHB – Sports Medicine
	Sports Medicine Attendings and Fellows	1 hour lecture each year

#### **Clinical Supervisory and Training Responsibilities**

1998-2004	Preceptor/Supervisor for undergraduate, graduate and medical students	80 hours each year
2000	Chief Resident, Orthopaedic Trauma Service, BWH, supervising orthopaedic residents	300 hours over six months
2002	Chief Resident, Pediatric Orthopaedic Service, CHB, supervising orthopaedic residents	100 hours over six months
2000-2005	Supervising of pediatric orthopaedic fellows and medical students for pediatric orthopaedic operative and non-operative conditions	10 hours per week
2000-2005	Supervising of pediatric sports medicine fellows and medical students for sports medicine operative and non-operative conditions	10 hours per week
2006-	Supervising of fellows and residents about sports medicine operative and non-operative conditions	5 hours per week

### Laboratory and Other Research Supervisory and Training Responsibilities

2004-present	Principal Investigator supervising post-	300 hours per year
	doctoral fellows, graduate students,	
	undergraduate students, medical students,	
	residents and fellows in the laboratory	

### **Formally Supervised Trainees**

2001-02 Brian Forsythe, MD/Assistant Professor, Rush University Medical Center Brian spent a year with me during residency during which time he published his first peerreviewed paper (he now has over 15) in sports medicine research.
2004-2006 Mena Mesiha, MD/Shoulder Fellow at MGH Mena spent a year with me studying the pathology of meniscal tears, during which time he presented his first paper at the Academy of Orthopaedic Surgeons and published his first peer-reviewed manuscript.

- 2005-2008 Duretti Fufa, MD/Hand Fellow, Washington University St Louis Duretti spent a year with me during medical school during which time she published her first two peer-reviewed papers and gained a strong interest in academic sports medicine.
- 2004-2007 Eduardo Abreu, PhD/Assistant Professor, University of Missouri Eduardo spent three years as a post-doctoral fellow in our lab during which time he published two first author manuscripts as well as assisting with multiple other projects.

### Formal Teaching of Peers (e.g., CME and other continuing education courses)

2003	Gene Therapy for Delivery of BMP-2 to Bone Defects	1
	Orthopaedic Resident Thesis Day	Children's Hospital Boston
2004	Intra-articular Tissue Non-union	1
	Harvard Combined Orthopaedic Residency Program	Children's Hospital Boston
2005	ACL Injuries in the Adolescent Female Athlete	1
	Inaugural Marino Lecture and Sports Medicine	Children's Hospital Boston
	Symposium	

## **Local Invited Presentations**

Those presentations below sponsored by outside entities are so noted and the sponsor identified

2002	Prevention of Knee Injuries for the Woman Athlete / Brigham and Women's Hospital
	Department of Orthonaedic Surgery Brigham and Women's Hospital
2004	Common Sport Medicine Problems in the Young Athlete
2004	Children's Hospital Boston
2004 -2005	Enhanced Primary Repair of the ACL – First Annual Symposium
2001 2002	Cellular Molecular and Clinical Research in Surgery - Children's Hospital Boston
2005	Enhanced Primary Repair of Intra-articular Tissues/ CIMIT Forum
	MGH
	Enhanced Primary Repair of the Anterior Cruciate Ligament
	Radiology Conference – Children's Hospital Boston
	1. Frontiers in Pediatric Surgery. 2. Knee Injuries in the Young Athlete
	Department of Orthopaedic Surgery, Children's Hospital Boston
	Prevention and Treatment of Injuries in the Adolescent Throwing Athlete
	Frontiers in Pediatric Surgical Specialties, Harvard Medical School
	Why Tissues in Joints Don't Heal/ Grand Rounds
	Medical Grand Rounds Bone Day- Children's Hospital Boston
	Enhanced Primary Repair of the Anterior Cruciate Ligament/ Grice Day Lecture
	Orthopaedics / Children's Hospital Boston
2006	Imaging Aspects of ACL Repair
	Sports Medicine /Radiology Conference/ Children's Hospital Boston
	Deficiencies in Joint Tissue Healing
	Dept. of Orthopaedic Surgery Data & Journal Club/ Children's Hospital Boston
	Case Studies Session
	Inaugural Marino Lecture and Sports Medicine Symposium / Children's Hospital Boston
	Importance of Funding Clinically Relevant Research
	CIVITI FORUM - MOH

2007	Common Sports Medicine Injuries: What to Treat and What to Refer.
	Frontiers in Pediatric Surgical Specialties, Harvard Medical School
	The Clinician Scientist as Inventor
	Inventors Day Symposium – Children's Hospital Boston
	Imaging of ACL Repair – Grand Rounds
	Department of Radiology – Children's Hospital Boston
2007, 2008	Primary Repair of the ACL
	Grice Day – Dept. of Ortho. Surgery / Children's Hospital Boston
2009	Enhanced Arthroscopic Repair of Knee Ligaments / Board Research Committee
	Department of Orthopaedic Surgery, Children's Hospital Boston
	Primary Repair of the ACL: Should We Go There Again
	Cellular, Molecular and Clinical Research in Surgery – Children's Hospital Boston
2010	Outcomes of ACL Surgery
	Dept. of Sports Medicine – Children's Hospital Boston
	Biological Enhancement of Ligament
	Inaugural Marino Lecture – Children's Hospital Boston
	Biologic Healing of Ligament Injuries
	Lecture for Animal Care Technicians – Children's Hospital Boston
	Biologic Enhancement of ACL Healing
	Dept. of Orthopaedic Surgery – Grice Day - Children's Hospital Boston
2012	2012 Grice Day Lecture – Children's Orthopaedic Surgery Foundation
	Bioenhanced ACL Repair

# **Report of Regional, National and International Invited Teaching and Presentations**

# **Invited Presentations and Courses**

Those presentations below sponsored by outside entities are so noted and the sponsor identified

Regional	
1999	Development of Scaffold for Intra-articular Use
	Center for Integration of Medicine and Innovative Technology Boston, MA
2002	Knee Injuries in the Young Athlete
	MetroWest Pediatricians, MetroWest Hospital, Natick MA
	Head Injuries / NSTAR Athletic Medicine Seminar
	Worcester, MA
	Kifoyle Award Lecture – New England Orthopaedic Society
2003	Enhanced Primary Repair of the ACL
	Center for Integration of Medicine and Innovated Technology, Boston MA
2004	Novel Approaches to Ligament Repair
	3 <sup>rd</sup> International meeting on Gene Therapy in Rheumatology and Orthopaedics, Boston
	MA
2006	ACL Injury Prevention Seminar
	Newton, MA
2007	Innovations in ACL Surgery: Why Bother?
	International Symposium on Innovation in Veterinary Surgery, sponsored by KyonMedica,
	Boston, MA
	Prevention of ACL Injuries in the High School Athlete / MARN

	Primary Repair of the ACL – Grand Rounds
	Dept. of Orthopaedic Surgery – Brown University - Providence, RI
2008	Primary Repair of the ACL: Advances and New Directions
	Northeastern University: Distinguished Lectures – Boston MA
2009	Prevention of ACL Injury
2011	Grand Rounds – The Biology of ACL Injury and Repair
	Yale Department of Orthopaedic Surgery – New Haven, CT
	ACL Injury Prevention Program – Norton, MA
2012	Tissue Engineering Solutions for ACL Repair
	Tufts University Bioengineering Program – Medford, MA

#### National

No presentation	ons below were sponsored by outside entities.
2001	The Biology of ACL Injury and Repair
	Vanderbilt University Department of Orthopaedics and Rehabilitation – Nashville TN
2004	Enhanced Primary Repair of the ACL
	Gordon Research Conference – Proctor Academy NH
2005	Regenerative Medicine: Clinical Needs, Barriers and Opportunities
	NIH/NIAMS Annual Extramural Retreat – Bethesda, MD
2005	Basic Science Considerations for Primary Repair of the ACL
	American Orthopaedic Society for Sports Medicine Annual Meeting – Keystone, CO
2006	ACL Prevention Program / MAHPERD Annual Convention
	Worcester, MA
2007	Repair of Intra-articular Injuries
	Vanderbilt University School of Medicine – Nashville, TN
2007	Primary Repair of the ACL: Should We Go There Again?
	UCLA – Department of Orthopaedic Surgery – Los Angeles, CA
2007	Primary Repair of the ACL: Should We Go There Again?
	UC Davis Bioengineering Department – Davis, CA
2007	Basic Science of ACL Repair
	University of Iowa – Department of Orthopaedic Surgery – Iowa City, IA
2007	Primary Repair of the ACL: Should We Go There Again
	University of Minnesota – Dept. Orthopaedic Surgery - Minneapolis, MN
2007	Primary Repair of the ACL: Should We Go There Again
• • • • •	Duke University – Durham, NC
2008	Advances in Primary Repair of the ACL
	Hospital for Special Surgery –Multicenter Orthopaedic Outcomes Network Meeting –
2000	New York, NY
2008	Primary Repair of the ACL
2000	University of Cincinnati – Dept. of Ortho. Surgery – Cincinnati, OH
2008	Advance in ACL Biology
2000	University of Cincinnati – Dept. of Biomedical Engineering – Cincinnati, OH
2008	New Horizons in ACL Repair - Symposium: The Female Athlete
2000	Cincinnati Unildren s Hospital, Uncinnati, UH
2009	Grand Kounds Speaker - Primary Repair of the ACL: Should we Go There Again

	The Mayo Clinic – Rochester, MN
2009	Visiting Professor – Why Tissue in Joints Don't Heal
	The Mayo Clinic – Rochester, MN
2009	Primary Repair of the ACL
	The Ruth Jackson Lecture – university of Iowa Hospitals & Clinics – Iowa City IA
2009	Grand Rounds – ACL Reconstruction: Can We Make a Great Operation Better?
	University of Pittsburgh - Pittsburgh, PA
2010	Ligament Repair
	Society for Pediatric Radiology – Boston MA
2010	Visiting Professor – Biologic Enhancement of ACL Repair and Reconstruction
	University of Penn. School of Medicine – Philadelphia, PA
2011	Invited Speaker – The Use of Scaffolds and PRP for Tendon and Ligament Healing
	American Orthopaedic Association – Boston, MA
2011	Grand Rounds – Primary Repair of the ACL: Should We Go There Again
	Columbia Department of Orthopaedic Surgery – New York, NY
International	
2008	Soft Tissue Repair: Bench to Bedside
	Tissue Engineering & Regenerative Medicine International Society – San Diego, CA
2011	The Effect of Age on ACL Functional Healing
	ISAKOS Meeting – Rio de Janeiro, Brazil
2011	The Biology of ACL Injury and Repair
	Kobe University – Kobe, Japan
2011	Primary Repair of the ACL
	Hiroshima University – Hiroshima, Japan
2011	The Biology of Ligament Injury and Repair
	JOSKAS Annual Meeting – Sapporo, Japan
2012	Grand Rounds: Primary Repair of the ACL: Should we go there again?
	University of Toronto - Toronto, Canada

# **Report of Clinical Activities and Innovations**

# **Current Licensure and Certification**

1994	Advanced Trauma Life Support – American College of Surgeons
1995	Diplomate - National Board of Medical Examiners
1999	Medical License – Massachusetts
2000	Human Research Certification - Partners HealthCare System
2005	Board Certified – American Board of Orthopaedic Surgery
2010	Subspecialty Certification Sports Medicine – American Board of Orthopaedic Surgery

# **Practice Activities**

Orthopaedic Surgery	Sports Medicine – Boston	Approx. 100 surgical cases a
	Children's Hospital	year
Ambulatory Care	Sports Medicine- Boston	
-	Children's Hospital	
Orthopaedic Research	Boston Children's Hospital	3 days per wk devoted to local educational programs for knee
	Orthopaedic Surgery Ambulatory Care Orthopaedic Research	Orthopaedic SurgerySports Medicine – Boston Children's HospitalAmbulatory CareSports Medicine- Boston Children's HospitalOrthopaedic ResearchBoston Children's Hospital

dedicated to developing new and improved treatments for knee ligament, meniscal and cartilage injury.

# **<u>Clinical Innovations</u>**

# **Report of Technological and Other Scientific Innovations**

Issued Patents	
Issue Date	Title
Priority Date	Inventors/Assignee
Patent Number	BCH Code
11/15/2005	Biologic Replacement for Fibrin Clot
6/22/1999	Murray, M. M., Murray, M. F., Marler, J.
	CMCC
11/23/2010	Biologic Replacement for Fibrin Clot
6/22/1999	Murray, M.M., Murray, M.F., Marler, J.
7,838,630	CMCC
8/9/2012	Biologic Replacement for Fibrin Clot
6/22/1999	Murray, M. M., Murray, M. F., Marler, J.
20120201896	CMCC
11/15/2012	Device for Mixing and Delivering Fluids for Tissue Repair
2/9/2005	Slocum, A., Carvey, M.R., Salamini, A., Walker, D., Wang, Y. Murray, M.M.
20090143765	CMCC 1354
Pending	
Applications	
Priority Date	Title
Patent Number	Inventors/Assignee
	BCH Code
9/2006	Methods and Procedures for Ligament Repair
20090306776	Murray, M.M.
	CMCC
	Continuation of PCT/US2007/021009, priority date 9/2006
1/27/2009	Methods and Collagen Products for Ligament Repair
20090254104	Murray, M. M.
	CMCC

<b>Provisional</b> <b>Applications</b> Filing Date Patent Number	Title Inventors/Assignee BCH Code
Feb 1, 2012 61/593,415	Biomaterials for Articular Cartilage Maintenance Murray, M. M., Fleming, B. C. CMCC
May 20, 2012	Protocol for manufacturing of collagen based scaffolds Murray, M. M., CMCC

# **Report of Education of Patients and Service to the Community**

### **Activities**

2011 Invited Lecturer – A Day in the Life of an Orthopaedic Surgeon-Scientist The Perry Initiative Delaware – Newark, DE Presentation to 33 female high school students interested in orthopaedic surgery and engineering.

## **Educational Material for Patients and the Lay Community**

Books, monographs, articles and presentations in other media

Educational material or curricula developed for non-professional students

Patient educational material

**Recognition** 

# **Report of Scholarship**

## **Publications**

Peer reviewed publications in print or other media

### **Research Investigations:**

 Murray, M. M., Spector, M. Fibroblast distribution in the anteromedial bundle of the human anterior cruciate ligament: The presence of α-smooth muscle actin-positive cells. J Orthop Res 1999 Jan; 17:18-26.

- 2. **Murray, M.M.,** Martin, S. D.,and Spector, M. The migration of cells from human anterior cruciate ligament explants into three dimensional collagen-glycosaminoglycan scaffolds *in vitro*. J Orthop Res 2000 Jul; 18 (4); 557-64.
- Qiu, W., Murray, M.M., Shortkroff, S., Lee, C. R., Martin, S. D., and Spector, M. Outgrowth of chondrocytes from human articular cartilage explants and expression of α-smooth muscle actin. Wound Repair and Regeneration 2000 Sep-Oct; 18 (5):383-391.
- 4. **Murray, M. M**., Martin, S. D., Martin, T. L., and Spector, M. Histologic changes in the human anterior cruciate ligament after rupture. J Bone Joint Surg Am, 2000; 82A(10):1387-1397.
- 5. Premdas, J., Tang, J.-B., Warner, J. P., **Murray, M.M.**, and Spector, M. The presence of smooth muscle actin in fibroblasts in the torn human rotator cuff. J Orthop Res, 2001 Mar; 19(2): 221-228.
- 6. Ahluwalia S., Fehm M., **Murray M. M.**, Martin S.D., and Spector, M. Distribution of Smooth Muscle Actin-Containing Cells in the Human Meniscus. J Orthop Res, 2001 Jul; 19(4): 649-654.
- 7. **Murray, M. M.** and Spector, M. The migration of cells from the ruptured human anterior cruciate ligament into collagen-glycosaminoglycan regeneration templates in vitro. Biomaterials 2001 Sep; 22:2393-2402.
- 8. **Murray, M. M.**, Bennett, R. L., and Spector, M. S. Cell Outgrowth from the human ACL in vitro: Regional variation and response to TGF-b1. J Orthop Res 2002 Jul; 20:875-880.
- 9. Spindler, K. P., **Murray, M. M.**, Detwiler, K. B., Tarter, J. T., Dawson, J. M., Davidson, J. M. The biomechanical response to doses of TGF-b2 in the healing rabbit medial collateral ligament. J Orthop Res, 2003 Mar; 21(2): 245-249.
- 10. **Murray, M. M.**, Rice, K., Wright, R. J. and Spector, M. The effect of selected growth factors on human anterior cruciate ligament cell interactions with a three dimensional collagen-GAG scaffold. J Orthop Res, 2003; 21:238-244.
- 11. Murray, M. M., Zurakowski, D., Vrahas, M. S., The death of articular chondrocytes after intraarticular fracture in humans. Journal of Trauma, 2004; 56: 128-131.
- 12. Kolker D, **Murray M. M**, Wilson M. Osteochondral defects of the talus treated with autologous bone grafting. J Bone Joint Surg Br, 2004; 86(4): 521-526
- Pascher A., Steinert A. F., Palmer G. D., Betz O., Gouze J.N., Gouze E., Pilapil C., Ghivizzani S.C., Evans C.H., Murray M.M. Enhanced Repair of the Anterior Cruciate Ligament by in Situ Gene Transfer: Evaluation in an in Vitro Model. Molecular Therapy 2004; 10(2): 327-336.
- 14. **Murray M. M.**, Weiler A., Spindler K. P. Interspecies Variation in the Fibroblast Distribution of the Anterior Cruciate Ligament. Am. J. Sports Med., 2004; 32:1484-1491.
- 15. **Murray M.M.**, Forsythe B, Chen F, Lee SJ, Yoo JJ, Atala A, Steinert A: The effect of thrombin on ACL fibroblast interactions with collagen hydrogels. J Orthop Res 2006 Mar; 24:508-515.
- 16. Spindler, K. P, **Murray, M.M.**, Devin, C., Nanney, L. B., Davidson, J. M. The central ACL defect as a model for failure of intra-articular healing. J Orthop Res 2006 Mar; 24:401-406.
- Murray, M.M., Spindler, K.P, Devin, C., Snyder, B. D., Muller, J., Ballard, P., Nanney, L. B., Zurakowski, D. Use of a collagen-platelet rich plasma scaffold to stimulate healing of the ACL. J Orthop Res 2006, 24:820-830

- Murray, M.M., Spindler, K.P., Abreu, E., Muller, J., Nedder, A., Kelly, M., Frino, J., Zurakowski, D., Valenza, M., Snyder, B.D.and Connolly, S.A. Collagen-Platelet Rich Plasma Hydrogel Enhances Primary Repair of the Porcine Anterior Cruciate Ligament. J Orthop Res. 2007, 25:81-91.
- 19. Mesiha, M., Zurakowski, D., Soriano, J., Nielson, J. H., Zarins, B., **Murray, M.M.** Pathologic Characteristics of the Torn Human Meniscus.Am. J. Sports Med. 2007, 35:103-112.
- 20. **Murray, MM.**, Spindler, KP., Ballard, P, Welch, T, Nanney, LB Enhanced histologic repair in a central wound in the anterior cruciate ligament with a collagen-platelet-rich plasma scaffold. J Orthop Res, 2007 Aug; 25(8):1007-1017.
- Steinert, AF., Weber, M, Kunz, M. Palmer, G.D., Noth, U., Evans, C.H., Murray, M.M.In situ IGF-1 gene delivery to cells emerging from the injured anterior cruciate ligament, Biomaterials, 2008 Mar; 29(7):904-16.
- 22. Fufa, D, Shealy, B, Jacobson, M, Kevy, S, **Murray, MM.** Activation of Platelet-Rich Plasma Using Soluble Type I Collagen. Journal of Oral and Maxillofacial Surgery J Oral Maxillofac Surg. 2008 Apr. 66(4):684-90.
- 23. Jacobson, M., Fufa, D., Abreu, E., Kevy, S., **Murray, M. M.** Platelets, but not erythrocytes, significantly affect cytokine release and scaffold contraction in a provisional scaffold model. Wound Repair and Regeneration, 2008; May-Jun;16(3):370-8.
- Fleming, BC., Carey J., Spindler, KP., Murray, MM. Can Suture Repair of ACL Transection Restore Normal Anteroposterior Laxity of the Knee? An Ex Vivo Study. J Orthop Res. 2008 Nov;26(11):1500-5.
- 25. **Murray, M.M**., Current Status and Future Potential of Primary ACL Repair, Clin Sports Med. 2009 Jan;28(1):51-61.
- 26. Pearse RV., Esshaki, D., Tabin, CJ., **Murray, M. M.** Genome-wide expression analysis of intra- and extra-articular connective tissue. J Orthop Res. 2009 Apr;27(4):427-34.
- 27. **Murray MM**, Palmer M, Abreu E, Spindler KP, Zurakowski D, Fleming BC. Platelet-Rich Plasma Alone Is not Sufficient To Enhance Suture Repair of the ACL In Skeletally Immature Animals: An In Vivo Study. J Ortho Res. 2009 May 27 (5): 639-45.
- Spindler, K.P., Murray, M.M., Carey J. L., Zurakowski, D, Fleming, B. C. The Use of Platelets to Affect Functional Healing of an Anterior Cruciate Ligament (ACL) Autograft in a Caprine ACL Reconstruction Model. J Orthop Res. 2009 May;27(5):631-8.
- 29. Palmer MP, Abreu EL, Mastrangelo A, Murray MM. Injection temperature significantly affects in vitro and in vivo performance of collagen-platelet scaffolds. J Orthop Res. 2009 Jul;27(7):964-71.
- Fleming, B.C., Spindler, K.P., Palmer, M., Magarian, E. and Murray, M.M... Collagen-platelet composites improve the biomechanical properties of healing ACL grafts in a porcine model. Am J Sports Med, 2009 Aug;37(8):1554-63.
- 31. Abreu EL, Palmer MP, **Murray, MM**. Storage Conditions Do Not have Detrimental Effect on Allograft Collagen or Scaffold Performance Cell Tissue Bank. 2009 Nov;10(4):333-40
- Joshi, S.M., Mastrangelo, A.N., Fleming, B.C., Murray, M.M. Collagen-Platelet Composite Enhances Biomechanical and Histologic Healing of the ACL, Am J Sports Med, 2009 Dec;37(12):2401-10.
- 33. Vavken P, Joshi S, **Murray MM**. Triton-X Is Most Effective Among Three Decellularization Agents for ACL Tissue Engineering. J Orthop Res. 2009 Dec;27(12):1612-8.
- 34. Vavken, P., **Murray, M.M.** Translational Studies in ACL repair. Tissue Eng Part B Rev. 2010 Feb;16(1):5-11.

- 35. Abreu, EL, Palmer MP, **Murray MM**. Collagen Density Significantly Affects The Functional Properties of an Engineered Provisional Scaffold .J Biomed Mater Res A. 2010 Apr;93(1):150-7
- Cheng, M.Y., Wang, H., Yoshida, R., Murray, M. M. Platelets and plasma proteins are both required to stimulate collagen gene expression by ACL cells in three-dimensional culture. Tissue Eng Part A. 2010 May;16(5):1479-89.
- 37. Mastrangelo, A.N., Magarian, E.M., Palmer, M.P., **Murray, M.M.** The Effect of Skeletal Maturity on the Regenerative Function of Intrinsic ACL Cells. J Orthop Res. 2010 May;28(5):644-51.
- Fleming, B.C., Magarian, E.M., Harrison, S.L., Paller, D.J. and Murray, M.M. Collagen Scaffold Supplementation does not improve the functional properties of the repaired anterior cruciate ligament. J Orthop Res, 2010 Jun;28(6):703-9.
- Murray, M. M., Magarian, E. Zurakowski D., and Fleming, B.C. Bone-to-Bone Fixation Enhances Functional Healing of the Porcine Anterior Cruciate Ligament Using a Collagen-Platelet Composite. Arthroscopy. 2010 Sep;26(9 Suppl):S49-57. 2010 Jun 11.Epub 2010 Jun 11.
- Haddad-Weber, M., Prager, P., Kunz, M., Seefried, L., Jakob, F., Murray, M.M., Evans, C.E., Noth, U. & Steinert, A.F. BMP12 and BMP13 gene transfer induce ligamentogenic differentiation in mesenchymal progenitor and anterior cruciate ligament cells. Cytotherapy. 2010 Jul;12(4):505-13.
- Mastrangelo, A.N., Haus, B., Vavken, P., Murray, M.M. Immature animals have higher cellular density in the healing anterior cruciate ligament than adolescent or adult animals. J Orthop Res. 2010 Aug;28(8):1100-6.
- 42. Vavken, P, Saad FA, **Murray, M.M.**, Age-dependence of expression of growth factor receptors in porcine ACL fibroblasts. J Orthop Res, 2010 Aug;28(8):1107-12.
- 43. **Murray, M. M.,** Magarian, E. M., Harrison, S.L, Zurakowski, D., and Fleming, B. C. The effect of skeletal maturity on functional healing of the anterior cruciate ligament. J Bone Joint Surg Am, 2010 Nov;92(11):2039-49.
- 44. Magarian E.M., Fleming, B.C., Harrison, S.L., Mastrangelo, A.N., Badger, G. and **Murray, M.M.** Delay of 2 or 6 weeks adversely affects the functional outcome of augmented primary repair of the porcine ACL. AJSM, 2010 Dec:38(12):2528-34.
- 45. Vavken, P, Joshi, SM., **Murray, MM.** Fibrin Concentration Affects ACL Fibroblast Proliferation and Collagen Synthesis. The Knee, 2011, Jan; 18(1):42-6.
- 46. Harrison, S, Vavken, P, Kevy, S, Jacobson, M, Zurakowski, D, **Murray, MM.** Platelet Activation by Collagen Provides Sustained Release of Anabolic Cytokines. Am J Sports Med. 2011 39(4):729-34.
- 47. Steinert, A, Kunz, M., Barthel, T, Jakob, F, Noeth, U, **Murray, MM.,** Evans, C, Porter, R. Mesenchymal Stem Cell Characteristics of Human Anterior Cruciate Ligament Outgrowth Cells. Tissue Engineering, Part A, 2011, May: 17(9-10):1375-88.
- 48. Haus, BM, Mastrangelo, AN, **Murray, MM.** The Effect of Anterior Cruciate Healing on the Uninjured Ligament Insertion Site. J Orthop Res, 2011, Jul 11, 30(1):86-94.
- Mastrangelo AN, Vavken P, Fleming BC, Harrison SH, Murray, MM. Reduced Platelet Concentration Does Not Harm PRP Effectiveness for ACL Repair in a Porcine In Vivo Model. J Ortho Res, 2011 Jul;29(7):1002-7.
- 50. Cheng, M, Johnson, V, **Murray, MM.** The Effects of Age and Platelet-Rich Plasma on ACL Cell Viability and Collagen Gene Expression. J Orthop Res, 2011, 30(1):79-85.
- 51. Proffen, BL, Fleming, BC, **Murray, MM.** A Comparative Anatomical Study of the Human Knee and Six Animal Species. Knee. 2012 Aug;19(4):493-9
- 52. Magarian, EM., Vavken, P, and **Murray, MM.** Human Anterior Cruciate Ligament Fibroblasts from Immature Patients Have a Stronger In Vitro Response to Platelet Concentrates Than Those from Mature Individuals. Knee. 2011 Aug;18(4):247-51.
- 53. Vavken, P, Sadoghi, P, **Murray, MM.** The Effect of Platelet Concentrates on Graft Maturation and Graft-Bone Interface Healing in ACL Reconstruction in Human Patients. A Systematic Review of

Controlled Trials. Arthroscopy, 2011, 27(11):1573-83.

- 54. Palmer, M, Stanford, E, Murray, MM.The Effect of Synovial Fluid Enzymes on the Biodegradability of Collagen and Fibrin Clots Materials (Basel). 2011 Aug 20;4(8):1469-1482 http://www.ncbi.nlm.nih.gov/pubmed/21949586
- 55. Harrison, S.L., Vavken, P., **Murray, MM.** Erythrocytes Inhibit Ligament Fibroblast Proliferation in a Collagen Scaffold. J Orthop Res. 2011 Sep 29(9):1361-6.
- 56. Fleming, BC, Vajapeyam, S, Connolly, S, Magarian, EM, Murray, MM. The Use of Magnetic Resonance Imaging to Predict ACL Graft Structural Properties. J Biomechanics, 2011 Nov 10;44(16):2843-6.
- 57. Vavken, P., Saad, FA, Fleming, BC., Murray, MM. VEGF Receptor mRNA Expression By ACL Fibroblasts is Associated with Functional Healing of the ACL. Knee Surg Sports Traumatol Arthrosc. 2011 Oct;19(10):1675-82. http://www.ncbi.nlm.nih.gov/pubmed/21331648
- 58. Vavken, P, Fleming, BC., Mastrangelo, AN., Machan, JT., **Murray, MM.** Biomechanical Outcomes after Bio-enhanced Anterior Cruciate Ligament Repair and Anterior Cruciate Ligament Reconstruction are Equal in a Porcine Model. Arthroscopy, 2012 May;28(5):672-80.
- 59. Magarian, EM, Vavken, P, Connolly, SA, Mastrangelo, AN and **Murray, MM**. Safety of Intra-Articular Use of Atelocollagen for Enhanced Tissue Repair. Open Orthopaedics Journal, 2012 May 6, 212-219.
- 60. Yoshida, R, Vavken, P, Murray, MM. Decellularization of Bovine Anterior Cruciate Ligament Tissues Minimizes Immunogenic Reactions to Alpha-Gel Epitopes by Human Peripheral Blood Mononuclear Cells. Knee. 2012 Oct;19(5):672-5.. NIHMS ID 318874.
- 61. Biercevicz, A, Miranda, DL., Machan, JT, Murray, MM, Fleming, BC. In Situ Non-Invasive T2\*-Weighted MRI Derived Parameters Determine Ex Vivo Structural Properties of an ACL Reconstruction or Bio-enhanced Primary Repair in a Porcine Model. Am J Sports Med. 2013 Jan 24. [Epub ahead of print]
- 62. Yoshida, R. Murray, MM. Peripheral Blood Mononuclear Cells Enhance the Anabolic Effects of Platelet-Rich Plasma on Anterior Cruciate Ligament Fibroblasts. J Orthop Res. 2013 Jan;31(1):29-34
- 63. **Murray, MM**, Fleming, BC. Use of a Bioactive Scaffold to Stimulate ACL Healing also Minimizes Post-traumatic Osteoarthritis after Surgery. Amer J Sports Medicine, accepted for publication 2013.
- 64. Vavken P, Proffen B, Peterson, C., Fleming BC, Machan JT, **Murray MM**. Effects of suture choice on biomechanics and physeal status after bioenhanced anterior cruciate ligament repair in skeletally immature patients: a large-animal study. Arthroscopy. 2013 Jan; 29(1):122-32. PMID 23200845
- 65. Proffen, BL, Haslauer, CM, Harris, CE, Murray MM. Mesenchymal Stem Cells from the Retropatellar Fat Pad and Peripheral Blood Stimulate ACL Fibroblast Migration, Proliferation and Collagen Gene Expression. Connect Tissue Res. 2013;54(1):14-21

## **Reviews:**

- 1. **Murray, M.M.**, Spindler, K.P., Anterior Cruciate Ligament Healing and Primary Repair. Sports Medicine and Arthroscopy Review, 2005; 13(3):151-155.
- 2. Mahan, S., **Murray, M.M**., Woolf, A., Kasser, J. Increased Blood Lead Levels in an Adolescent Girl from a Retained Bullet: A Case Report. J Bone Joint Surg. 2006 Dec; 88(12):2762-9.

- 3. Steiner, ME, **Murray, M.M.** and Rodeo, S.A. Strategies to Improve Anterior Cruciate Ligament Healing and Graft Placement, American Journal of Sports Medicine, 2008; Jan;36(1):176-89.
- 4. Butler, DL, Lewis, JL, Frank, CB, Banes, AJ, Caplan AI, DeDeyne, PG, Dowling, M, Fleming BC, Glowacki, J, Guldbery, RE, Johnstone, B, Kaplan DL, Levenston, ME, Lotz, JC, Lu, EY, Lumelsky, N, Mao, JJ, Mauck, RL, McDevitt, CA, Mejia, LC, **Murray, M.M.**, Ratcliffe, A, Spindler KP, Tashman, S, Wagner, CT, Weisberg, EM, Williams, C, Zhang, R. Evaluation Criteria for Musculoskeletal and Craniofacial Tissue Engineering Constructs: A Conference Report. Tissue Engineering, Tissue Eng Part A. 2008 Dec;14(12):2089-104.
- 5. Vavken, P., **Murray**, **M.M.** Translational Studies in ACL repair. Tissue Eng Part B Rev. 2010 Feb;16(1):5-11.
- 6. Kleinman, PK, **Murray, M.M**., et al, Posterior periosteal disruption in Salter-Harris II fractures of the distal femur: Evidence for a hyperextension mechanism, Am J Roentgenol. 2009 Dec; 193(6)W540-5
- 7. Vavken, P, **Murray, M. M.** Treating Anterior Cruciate Ligament Tears in Skeletally Immature Patients. Arthroscopy, 2011 May 1;27(5):704-716.
- 8. Vavken, P., **Murray, M. M.**, The potential for primary repair of the ACL. Sports Med Arthroscopy. 2011, Mar;19(1):44-9.

## Non-peer reviewed scientific or medical publications/materials in print or other media

- 1. **Murray, M. M.,** Effect of the intra-articular environment on healing of the ruptured anterior cruciate ligament. Invited Editorial, electronic J Bone Joint Surgery (Am), August 2001.
- 2. **Murray, M. M.**, Mankin, H. J., Glowacki, J. The Musculoskeletal System. In:O'Leary, JP editor. The Physiologic Basis of Surgery, 3<sup>rd</sup> Edition, Lippincott Williams and Wilkins, 2002.
- 3. Bernstein, J, senior editor. **Murray, M. M**. section editor for Basic Science. Musculoskeletal Medicine. American Academy of Orthopaedic Surgeons, Rosemont, IL, 2003.
- 4. Steinert A.F., Chen F., Evans C.H., **Murray M..M.** Novel Biological Approaches to Enhance Primary Repair of the Anterior Cruciate Ligament. The Orthopaedic Journal at Harvard Medical School, 2004; 81-83.
- 5. **Murray, M. M.**, Spindler, K. P., Anterior Cruciate Ligament Healing and Primary Repair, Sports Medicine and Arthroscopy Review, 2005; 13(3), 151-6.
- 6. **Murray, M. M.**, Murray, M. F., Biology and Gene-Based Therapy. In: Kocher, MS and Micheli, LJ, eds. The Pediatric and Adolescent Knee, 2006.
- 7. **Murray, M. M.**, Mankin, H. J., Glowacki, J. The Musculoskeletal System. In:O'Leary, JP editor. The Physiologic Basis of Surgery, 4th Edition, Lippincott Williams and Wilkins, 2007.
- 8. **Murray, M. M.** The Future of Sports Medicine, In: Encyclopedia of Sports Medicine, Micheli, LJ ed., Sage Publications, 2008.
- 9. **Murray, M. M.**, Meniscal Injuries, In: Encyclopedia of Sports Medicine, Micheli, LJ ed., Sage Publications, 2008
- 10. **Murray, M. M.,** ACL Injuries, In: Encyclopedia of Sports Medicine, Micheli, LJ ed., Sage Publications, 2008.
- Murray MM, Vavken P. Regenerative Medicine and cranial cruciate repair. In: Muir P (Ed) Advances in Veterinary Surgery: The Canine Cranial Cruciate Ligament. Wiley-Blackwell, 2010.
- 12. Haslauer, C. M. and **Murray, M.M.** Early Evolution of a Disruptive Technology: ACL Repair and Regeneration. Orthopaedic Journal of the Harvard Medical School, 2012.
- 13. Chao, L., **Murray, M.M**. The Effects of Age and Skeletal Maturity on Enhanced Primary Repair of the Anterior Cruciate Ligament. Orthopaedic Journal of the Harvard Medical School, 2012.
- 14. Vavken P, Murray MM. ACL reconstruction in skeletally immature patients. How can we improve

the high rate of fail outcomes? In: Sanchis-Alfonso V, Monllau JC: The ACL-Deficient Knee. An Approach Based on Problem Resolution. Springer London. 2012.

- 15. Vavken P, **Murray MM.** The stimulation of healing of the anterior cruciate ligament. Research and Clinical Relevance. In: Sanchis-Alfonso V, Monllau JC: The ACLDeficient Knee. An approach based on problem resolution. Springer, London. 2012.
- Proffen, B., Fleming, B.C., Palmer, R. and Murray, M. M. The mature sheep as an animal model for bio-enhanced cruciate ligament repair and reconstruction. The Knee: Current Concepts in Kinematics, Injury Types and Treatment Options. Nova Science Publishers, 2012.
- Vavken, P. and Murray, M.M. "The stimulation of healing of the anterior cruciate ligament. Research and Clinical Relevance", In "The ACL-Deficient Knee. An Approach Based on Problems Resolution", Editors: Vicente Sanchis-Alfonso and Joan CarlesMonllau. Publisher: Springer London, 2012.
- Vavken, P., Micheli, L.J. and Murray, M.M., "ACL Injuries in Skeletally Immature Patients and Adolescents: How can we improve the High Rate of Poor Outcomes?" In "The ACL-Deficient Knee. An Approach Based on Problems Resolution", Editors: Vicente Sanchis-Alfonso and Joan CarlesMonllau. Publisher: Springer London, 2012.
- 19. Murray, M.M., Vavken, P., Fleming, B.C. The biology of ACL injury and repair. Springer, 2012.

## Professional educational materials or reports, in print or other media

Murray, M. M., "E. R. Ortho", Resident Handbook, Harvard Combined Orthopaedic Residency Program, 1998, 1999.

## **Clinical Guidelines and Reports**

Computer-based pre-operative plans for 1) Orthopaedic Trauma in adults, 2) Orthopaedic Trauma in children, 3) Common Sports Medicine surgical procedures. Pre-operative planning templates for orthopaedic residents and fellows preparing for surgical cases. Published on the Harvard Combined Orthopaedic Resident's website MD Beacon. Used only by permission of the residents and graduates of the Harvard Combined Orthopaedic Residency Program.

## **Thesis**

Murray, M. M., Guided Tissue Regeneration of the ACL: Preliminary Studies; Harvard Combined Orthopaedic Residency Program, 1999.

## Abstracts, Poster Presentations and Exhibits Presented at Professional Meetings

Palmer, R, Fleming, BC, Murray, MM "Primary Repair of the Anterior Cruciate Ligament Using a Bio-Active Scaffold In a Mature Ovine Model: A Preliminary Study", Podium Presentation, Veterinary Orthopaedic Society Meeting, Snowmass, CO, 2011.

Chao, L, Zurakowski, D and Murray MM. Platelet-Rich Plasma Suppresses TNF-alpha Secretion by Peripheral Blood Mononuclear Cells, Poster Presentation, Orthopaedic Research Society Annual Meeting, Long Beach, CA 2011.

Yoshida, Ryu, Vavken, P and Murray, M.M. Decellularization of Porcine ACL Eliminates Immunogenic Reactions to Alpha-gal Epitope by Human Peripheral Blood Mononuclear Cells, Podium Presentation, Orthopaedic Research Society Annual Meeting, Long Beach, CA 2011 Cheng, Ming-Yu, Murray, MM, The effects of age and platelet-rich plasma on the ACL cell viability and collagen production, Poster Presentation, Orthopaedic Research Society Annual Meeting, Long Beach, CA 2011

## **Narrative Report**(limit to 500 words)

I am a surgeon-scientist with a strong interest in injuries of the anterior cruciate ligament (ACL) of the knee. I spend half of my time treating patients with these injuries and the other half in the laboratory, trying to devise better solutions for patients with these injuries. I have made some progress in this area over the last twenty years, and am increasingly invited to share what we have found with others who are interested in improving patients with these and similar injuries.

My area of excellence is in investigation. I have over 60 peer-reviewed publications in the area of musculoskeletal injuries, with the majority concerning the ACL and methods to encourage its regeneration after injury. I am currently the principal investigator on three R01 grants and an ARRA supplement, with total direct costs for these grants at over \$6 million dollars. With this support, we have been able to identify and optimize new treatment methods for patients with ACL injuries. We are currently working on defining the effect of age on the capacity for ligament healing, and how to help older patients heal as effectively as young patients seem to. It is our hope that the discoveries we have made to date, and those we have yet to define, will reshape the way patients with musculoskeletal injuries are treated in the future.

I am also involved in the teaching of medical students, residents and fellows. I participate annually in the physical examination for medical students at HarvardMedicalSchool and have also taught in the Musculoskeletal Pathophysiology Course as well as HST 906 – The Role of Physicians and Scientists in the Business world. I also teach orthopaedic residents and fellows – with formal lectures two to three times a year on aspects of sports medicine and ACL injuries – as well as weekly in the office and in the operating room. I also mentor and teach the undergraduate, graduate and post-doctoral students in my laboratory on varied aspects of research – from the practicalities of conducting large animal surgeries to writing effective papers and grants. I also teach regularly on a national level, as a visiting professor or invited lecturer, and have recently been invited to serve as the Chairman of the Scientific Committee for the international ACL Study Group, where I hope to have the opportunity to teach an even wider audience about what we have learned about ACL injuries and their treatment.

I truly enjoy being a surgeon scientist. I enjoy caring for my patients, enjoy teaching others what I have learned about caring for patients, and I feel honored to be able to also spend time working toward finding improved solutions for people who sustain tendon and ligament injuries. Working at the junction between clinical care and research has been extremely rewarding and I hope to continue this path.