

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
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NAME Sean C. Mackey, M.D., Ph.D.	POSITION TITLE Chief, Division of Pain Management		
eRA COMMONS USER NAME MACKEY.SEAN	Associate Professor of Anesthesia & Pain Management		
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of Pennsylvania	B.S.E.	1986	Bioengineering
University of Pennsylvania	M.S.	1986	Bioengineering
University of Arizona	Ph.D.	1994	Electrical Engineering
University of Arizona	M.D.	1994	Medicine

A. Positions and Honors.**Professional Experience:**

1985 Research Engineer, La Jolla Technology, La Jolla, CA
 1985-1986 Research Assoc./Biomedical Engineer, Dep. of Pulmonary Medicine VA Hosp., Philadelphia, PA
 1995-1996 Intern, Transitional, Tucson Medical Center, Tucson, AZ
 1996-1998 Resident, Anesthesia, Stanford University Medical Center, Stanford, CA
 1997-1998 Chief Resident, Anesthesia, Stanford University Medical Center, Stanford, CA
 1998-1999 Fellow, Pain Management, Stanford University Medical Center, Stanford, CA
 1999-2000 Acting Assist. Professor of Anesthesiology, Stanford University Medical Center, Stanford, CA
 2000-2007 Asst. Prof. Anesthesia & Pain Management, Stanford University Medical Center, Stanford, CA
 2000-Present Director - Regional Anesthesia Services, Stanford University Dep. of Anesthesia, Stanford, CA
 2004-2007 Associate Director – Pain Management Division, Stanford University Dep. Anesth., Stanford, CA
 2004-Present Co-Director – Pain Working Group – Stanford University Neuroscience Institute
 2005-Present American Society of Anesthesiology Anesthesiology Continuing Education (ACE) Board
 2007-Present NHLBI Workshop on Sickle Cell Disease Sub-Committee on Pain
 2007-Present California Department of Workers Compensation
 2007-Present Associate Prof. Anesthesia & Pain Management, Stanford Univ. Medical Center, Stanford, CA
 2007-Present Chief - Pain Management Division, Stanford University Dep. Anesth., Stanford, CA
 2008-Present International Association for the Study of Pain Pain Clinic Guidelines Taskforce
 2008-Present Director at Large, American Academy of Pain Medicine

Honors and Awards:

1987 GTE Electrical Engineering Scholarship
 1987 Etta Kappa Nu, Electrical Engineering Honor Society
 1989-1990, 1994 NIH Short-Term Research Fellowship Award
 1991-1992 Alpha Omega Alpha Honor Society Research Fellowship Award
 1992, 1994 Yuma Friends of Arizona Health Sciences Center Young Investigator Award
 1994 American Federation for Clinical Research Medical Student Award
 1994 University of Arizona MD/PhD Academic Scholarship
 1994 Van Winkle Award for Excellence in Surgical Research
 1994 Upjohn Medical Student Research Superstar Award
 1994 Honors and Awards Committee Research Award, AHSC
 1998 Patent - "Radio Frequency Energy Delivery System For Multipolar Electrode Catheters", USO583700
 2000 Cognitive Neuroscience Grant for Clark Center for Bioengineering, Biomedicine and Bioscience
 2002, 2005 Top Doctors in America published in "Guide to Top Doctors" 2002, 2005
 2003 Stanford Department of Anesthesia, Teacher of the Month, March 2003

B. Selected peer-reviewed publications.

1. Simmons, W.N., **Mackey, S.**, He, D.S., Marcus, F.I. *Comparison of Maximum Myocardial Lesion Depth Using Radiofrequency Energy Delivered with a Gold or Platinum Electrode*, Pacing and Clinical Electrophysiology, April 1996; 19: 398-402
2. **Mackey, S.** He, D., Thornton, L., Lampe, L., Marcus, F.I. *Simultaneous Multipolar Radiofrequency Ablation in the Monopolar Mode Increases Lesion Size*, Pacing and Clinical Electrophysiology, July 1996;19:1042-1048
3. Macario, A., **Mackey, S.**, Terris, D. *Bilateral Vocal Cord Paralysis After Radical Cystectomy in a Patient with a History of Bulbar Polio*, Anesthesia and Analgesia, 1997 Nov;85(5):1171-2
4. Angst, M.S., **Mackey, S.**, Zupfer, G., Taturu, C., Brock-Utne, J.G. *Reduction of Propofol Injection Pain with a Double Lumen IV-Set*, Journal of Clinical Anesthesia, September 1997, 9:462-66
5. Brodsky, J.B., **Mackey, S.** *Isolation Techniques – Advances in Thoracic Anesthesia and Postoperative Care*, Seminars in Cardiothoracic and Vascular Anesthesia, September 1997, 1:3;225-35
6. Brodsky, J.B., **Mackey, S.**, Cannon, W.B. *Selecting the Correct Size Left Double-Lumen Tube*. J Cardiothorac Vasc Anesth, 1997 Dec;11(7):924-5
7. **Mackey, S.**, Brodsky, J.B. *Selection and Placement of the Double-Lumen Tube in the Asian Patient*. Asian Cardiovascular & Thoracic Annals, 1998, Vol. 6, No. 3; 199-202
8. Leong, M., **Mackey S.** *Delayed Subdural Anesthesia after Stellate Ganglion Block*, Anesthesiology, February 2001, 94(2); 358-59
9. Sze D., **Mackey S.** *MR-Guidance of Sympathetic Nerve Blockade and Measurement of Vasomotor Response*. Radiology, 2002, 223: 574-580
10. **Mackey S.** Mechanisms of Inflammatory Pain: Therapeutic Implications. Journal of Clinical Rheumatology, June 2004, Vol. 10, Issue 3S: S5-11
11. **Mackey S.**, Maeda F. *Functional Imaging and the Neural Systems of Chronic Pain*. Neurosurgery North American Clinics Neurosurgery Clinics of North America, July 2004, Vol. 15, No. 3; 269-288
12. Ochsner K., Knierim K., Ludlow D., Hanelin J., Ramachandran T., Glover G., **Mackey S.** *Reflecting Upon Feelings: An fMRI Study of Neural Systems Supporting the Attribution of Emotion to Self and Other*. Journal of Cognitive Neuroscience, December 2004, 16:10; 1746-1772
13. Shinaman RC, **Mackey S.** *Continuous Peripheral Nerve Blocks*, Current Pain and Headache Reports, 2005, 9, 24-29
14. deCharms C, Maeda F, Glover G, Ludlow D, Pauly J, Soneji D, Gabrieli J, **Mackey S.** *Control Over Brain Activation and Pain Learned by Using Real-Time Functional MRI*. PNAS, December 2005, 102:51; 18626-31
15. Ochsner K, Ludlow D, Knierim K, Hanelin J, Ramachandran T, Glover G, **Mackey S.** *Neural Correlates of Individual Differences in Pain-Related Fear and Anxiety*. Pain, January 2006, 120:69-77
16. **Mackey S.**, Feinberg S *Pharmacologic Therapies for Complex Regional Pain Syndrome*. Current Pain and Headache Reports, February 2007, 11:1, 38-43
17. Mitra R, Zeighami A, **Mackey S.** *Pulsed radiofrequency for the treatment of chronic ilioinguinal neuropathy*. Hernia, February 2007, 11:4; 369-71
18. **Mackey S.**, Younger J, *Neuroimaging the Central Nervous Components of Neuropathic Pain*. US Neurological Disease, Issue II, January 2007 (Epub ahead of print)
19. Kornelsen J, **Mackey S.** *Potential Clinical Applications for Spinal Functional MRI*. Current Pain and Headache Reports, June 2007, 11:3; 165-70
20. Carroll I, **Mackey S.**, Gaeta R, , *The role of adrenergic receptors and pain: The good, the bad, and the unknown*. Seminars in Anesthesia and Perioperative Pain, March 2007, 26:1; 17-21
21. Zaki J, Ochsner K, Hanelin J, Wager T, **Mackey S.** *Different circuits for different pain: Patterns of functional connectivity reveal distinct networks for processing pain in self and others*. Interpersonal Sensitivity: A special issue of Social Neuroscience, September 2007, Psychology Press.
22. Carroll I, Gaeta R, **Mackey S.** *Multivariate Analysis of Chronic Pain Patients Undergoing Lidocaine Infusions: Increasing Pain Severity and Advancing Age Predict Likelihood of Clinically Meaningful Analgesia*. Clinical Journal of Pain, October 2007, 23:8; 702-6
23. Carroll I, Kaplan K, **Mackey S.** *Mexiletine Therapy for Chronic Pain: Survival Analysis Identifies Factors Predicting Clinical Success*. Journal of Pain and Symptom Management January 2008, Vol 35:3; 321-6
24. Ochsner K, Zaki J, Hanelin J, Ludlow D, Knierim K, Ramachandran T, Glover G, **Mackey S.** *Your pain or mine? Common and distinct neural systems supporting the perception of pain in self and other*. Social Cognitive and Affective Neuroscience, 2008, 3:2; 144-60.

25. Godfrey J, **Mackey S**, *Toward optimal health: a discussion on sex, gender, and pain*. Journal of Women's Health, July-August 2008, 17:6; 917-20.
26. Lawrence J, **Mackey S**, *Role of neuroimaging in analgesic drug development*. Drugs in R&D, 2008, 9:5; 323-34.
27. Neugebauer V, Galhardo V, Maione S, **Mackey S**, *Forebrain pain mechanisms*. Brain Research Reviews, 2009, 60; 226-242.
28. Carroll I, Clark D, **Mackey S**, *Sympathetic Block with Botulinum Toxin to Treat Complex Regional Pain Syndrome*. Annals of Neurology, 2009, 65; 348-51.
29. Coleman S, **Mackey S**, *Spinal cord stimulation compared with medical management for failed back surgery syndrome*. Current Pain and Headache Reports, 2009, 13:1; 1-2.
30. Younger J, McCue R, **Mackey S**, *Pain outcomes: A brief review of instruments and techniques*. Current Pain and Headache Reports, 2009, 13:1; 39-43.

C. Research Support.

Ongoing Research Support

R01 NS053961-01 PI: Mackey

01/09/06 – 12/31/2010

NIH NINDS

fMRI of Pain in the Human Spinal Cord

The overall goal of this project is to use human spinal fMRI to elucidate mechanisms of nociceptive processing and spinal cord plasticity in healthy subjects and patients with chronic neuropathic pain.

R21 DA023609 PI: Mackey

5/15/09 – 4/30/11

NIH NIDA

Learned Control of Frontal and Limbic Systems via Real-Time fMRI

K99 DA023609-01 PI: Jarred Younger (postdoc in lab) Mentor & Co-Investigator: Mackey

9/30/07 – 8/31/09

NIH NIDA

Mechanisms of Opioid-Induced Hyperalgesia in Pain Patients: Examination via fMRI

K99/R00. The major goal of the this project is to characterize the central neural correlates of opioid induced hyperalgesia in chronic pain patients consuming chronic opioids.

K23 DA25152 PI: Ian Carroll, Mentor & Co-Investigator: Mackey

9/1/08 – 8/31/13

Prescription Opioid Use, Misuse, and Pain in Post-Surgical Patients

1 U01 DK082316 (Consortium PI: Mackey)

9/15/08 – 6/30/09

NIH NIDDK / University of Pennsylvania

Central Mechanisms of Urologic Pelvic Pain: Functional and Structural Analysis by MRI

American Fibromyalgia Syndrome Association (PI: Mackey)

1/1/08 – 1/1/09

Low-Dose Naltrexone in the Treatment of Fibromyalgia

Eli Lilly Investigator Initiated Grant – PI: Mackey

12/6/06 – 12/31/08

Duloxetine: Functional MRI Neural Correlates of Efficacy in Patients with Chronic Low Back Pain

The major goal of this project is to characterize the effects of duloxetine, a balanced norepinephrine and serotonin reuptake inhibitor, on patients with chronic low back pain. This will utilize validated outcome measures and fMRI techniques.

Dodie and John Rosekrans Pain Research Endowment Fund Director: Mackey 2001 – Forever

This endowment is used to support projects related to functional neuroimaging of pain processing and perception. The primary project is: *Functional MRI in Patients with Chronic Pain: Effects of a Cognitive Behavioral Therapy Program*. The goals of this project are to: (1) Develop functional magnetic resonance imaging (fMRI) protocols to assess brain activation during the experience of pain and while patients attempt to cognitively control their pain response. (2) Identify pre vs. post-cognitive behavioral therapy patterns of change in brain activation that may be used to discriminate those who do and do not benefit from this form of therapeutic intervention.

Cognitive Neurosciences Grant-Clark Center for Bioengineering

2000 – Present

Advanced Imaging Techniques Applied to Pain Research – Functional Magnetic Imaging of the Human Spinal Cord and Brain

The goals of this project are to develop psychophysical tools to be used in the Magnetic Resonance Imaging facility to support ongoing studies into the neural circuitry responsible for pain processing.

Completed Research Support:

5 R44 NS050642-04 PI: deCharms, Consortium PI: Mackey

06/25/04 – 07/31/07

Omneuron Inc (Prime: NIH NINDS)

Applications of Real Time fMRI-Pzase II

The major goal of this project is to develop novel computational technologies and methods to control cognitive and behavioral training tasks using information from real time functional magnetic resonance imaging.

SBIR Phase II Fast Track Contract: Virtual Reality and Real Time fMRI

PI: deCharms, Consortium PI: Mackey

1/18/05 – 01/18/07

Omneuron Inc (Prime: NIH)

The major goal of this project is to use a combination of virtual reality and real time fMRI to significantly enhance a patient's ability to control activation in brain areas related to pain regulation.

Foundation for Anesthesia Education and Research PI: Mackey

2004-2006

Imaging Neural Systems in Complex Regional Pain Syndrome

The aim of this proposal was to investigate abnormalities of neuronal function in brain regions associated with pain processing in patients with CRPS using functional magnetic resonance imaging.

Foundation for Anesthesia Education & Research PI: Carroll, Mentor: Mackey 1/1/07 – 8/31/08

Mentored Research Training Grant:

Mechanisms of Analgesic Response During IV Lidocaine Infusion in Neuropathic Pain Patients

5 R43 MH067290-02 NIMH

Applications of Real Time fMRI Decharms (PI)

12/20/02-11/30/04

The major goal of this project is to develop novel computational technologies and methods to control cognitive and behavioral training tasks using information from real time functional magnetic resonance imaging (fMRI).

Role: Co-Investigator

NIH Short-Term Research Fellowship PI: Mackey

1989, 1990, 1994

Optimal Control of Transvenous Catheter Ablation in the Treatment of Tachyarrhythmias

The major goals of this project were to: determine the optimal delivery parameters for delivery of radiofrequency energy, apply computer modeling techniques to predict the effects of ablation energy on the myocardium, characterize energy losses in delivery system, and determine temperatures within myocardium during ablation.

Alpha Omega Alpha Honor Society Research Fellowship PI: Mackey

1991-1992

Transvenous Catheter Delivery of Electrical Energy to Ablate Arrhythmogenic Tissue in Patients with Tachyarrhythmias

The major goal of this project was to develop techniques and tools to reliably deliver radio-frequency energy to the myocardium to ablate cardiac arrhythmias

American Heart Association Fellowship PI: Mackey

1990-1991

Characterization and Optimization of Radiofrequency Catheter Ablation for the Treatment of Cardiac Arrhythmias

The major goal of this project was to develop numerical models to predict and control the effects of radio-frequency energy on the human myocardium for the treatment of cardiac arrhythmias

American College of Cardiology Research Grant PI: Mackey

1994

Electrical and Thermal Characterization of Radiofrequency Catheter Ablation

Oxnard Foundation Grant PI: Mackey

2001 - 2004

Use of NMDA-Antagonists and Opiates in the Treatment of Fibromyalgia Using Validated Outcome Measurements and Functional Magnetic Resonance Imaging

The goals of this project are to (1) investigate the neural processing of the perception of pain in patients with fibromyalgia compared to healthy volunteers (2) determine the effects of NMDA-antagonists and opiates on quality of life, function and subjective pain experience using validated outcomes tools and fMRI

Stanford Office of Technology Licensing Grant PI: Mackey

2001-2003

Processing of Pain in the Human Central Nervous System: Analysis through Functional Magnetic Resonance Imaging

Department of Anesthesiology Research Grant PI: Mackey

1999-2003

Interventional Magnetic Resonance Imaging Applied to Regional Anesthesia and Pain Medicine

Department of Anesthesiology Research Grant PI: Mackey

1999-2003

Development of a Human Neuropathic Pain Model and Determination of Effects of Intravenous Lidocaine on the Sensory and Affective Components of Pain