APPLICANT BIOGRAPHICAL SKETCH

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NAME OF APPLICANT: Craig Allan Lehocky

eRA COMMONS USER NAME (credential, e.g., agency login): calehocky

POSITION TITLE: Predoctoral Fellow

EDUCATION/TRAINING *(Most applicants will begin with baccalaureate or other initial professional education, such as nursing. Include postdoctoral training and residency training if applicable. High school students should list their current institution and associated information. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	START DATE MM/YYYY	END DATE *(or expected end date)* MM/YYYY	FIELD OF STUDY
University of Pittsburgh	B.S.E.	08/2004	04/2009	Bioengineering
University of Pittsburgh	B.S.	08/2004	04/2009	Neuroscience
Carnegie Mellon University	Ph.D.	08/2011	12/2015	Biomedical Engineering
University of Pittsburgh	M.D.	08/2009	05/2017	Medicine

A. Personal Statement

My research interests have continually bordered the boundaries between the neurosciences and engineering. Previous research experiences in molecular neuroscience, neurophysiology, and device engineering have culminated in my current position as a graduate student of the Surgical Robotics lab in the Robotics Institute of Carnegie Mellon University. Here, my interests in neuroscience and biomedical engineering intersect as I am developing a robotically controlled needle that can be navigated in three dimensions within the brain. Using flexible needles and a novel control paradigm, these needles can be navigated along pre-planned paths within brain parenchyma in order to avoid critical brain areas or vasculature. This technology will allow for deep structures of the brain to safely accessed in order to deliver chemotherapeutic drugs or to biopsy a tumor bed. My training in the Surgical Robotics lab is preparing me for a career as a physician-scientist, in which I plan to develop practical technological solutions for neurological disorders, as well as research tools for understanding basic neurophysiologic function.

B. Positions and Honors

ACTIVITY/ OCCUPATION	START DATE (mm/yy)	ENDING DATE (mm/yy)	FIELD	INSTITUTION/ COMPANY	SUPERVISOR/ EMPLOYER
PhD Student	08/11	12/15	Biomedical Engineering	Carnegie Mellon University	Dr. Cameron Riviere
Graduate Student Researcher	05/10	08/10	Neuroscience	University of Pittsburgh	Dr. David Lewis
Graduate Student Researcher	05/09	08/09	Bioengineering	University of Pittsburgh	Dr. Aaron Batista

ACTIVITY/ OCCUPATION	START DATE (mm/yy)	ENDING DATE (mm/yy)	FIELD	INSTITUTION/ COMPANY	SUPERVISOR/ EMPLOYER
Undergraduate Researcher	04/08	04/10	Medical Simulation	UPMC WISER Center	Dr. Joseph Samosky
Undergraduate Researcher	04/07	03/09	Neural Prostheses	University of Pittsburgh	Dr. Aaron Batista
Undergraduate Researcher	04/06	01/07	Molecular Neuroscience	University of Pittsburgh	Dr. Henry Zeringue
Undergraduate Researcher	04/05	03/06	Artificial Organs	University of Pittsburgh	Dr. William Wagner

Academic and Professional Honors

Scholarships and Fellowships

2004 U. Pitt. University Scholar scholarship; Honors in Engineering scholarship.
2005 U. Pitt. School of Engineering +3 Study Abroad scholarship (Beijing, China).
2006 U. Pitt. Bioengineering Summer Research Experience for Undergraduates fellowship.
$4,000 stipend to study NMDA receptor subunit expression (Zeringue lab)
2007-08 Center for the Neural Basis of Cognition: Program in Neural Computation Year-Long Research Fellowship.
$11,000 yearlong stipend to study temporal correlations of motor neurons (Batista lab)
2008 Center for the Neural Basis of Cognition: Computational Neuroscience Summer Research Fellowship.
$4,000 stipend to model fast timescale correlations in premotor cortex (Batista lab)
2008-09 2R25 MH054318. National Institute of Mental Health: Mental Health Research Fellowship.
$21,180 yearlong stipend to study visual field influences on premotor neurons (Batista lab)
2009- Medical Scientist Training Program (full funding for MD and PhD), U. Pitt. and CMU
2012 Bertucci Fellowship (tuition support fellowship of $10,000 awarded to four engineering graduate students at CMU)
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2014 Graduate Small project Help (GuSH) Research Funding.
$750 from CMU graduate student association for research supplies.
2015 CMU Dissertation Writing Group Award

Academic Honors and Positions

2004-09 Dean's List, U. Pitt.
2005 Honorable mention at McGowan Institute Scientific Retreat for poster *Polk et al.*
2005,07 U. Pitt. Ice Hockey Academic MVP
2007 U. Pitt. School of Engineering George Washington Prize finalist (for academics, leadership and service in engineering. 1 of 3 students selected)
2008 American Collegiate Hockey Association Academic All-American
2008 Energy-Efficient Building Technologies Challenge finalist, U. Pitt.
2008 President, U. Pitt. Biomedical Engineering Society (BMES)
2008 Secretary, U. Pitt. Tau Beta Pi
2009 Social Chair, Pitt/CMU Medical Scientist Training Program
2010 Interviewing Committee, Biomedical Engineering, Pitt/CMU Medical Scientist Training Program
2012 Admissions Screening Committee, Pitt/CMU Medical Scientist Training Program
2012 Peer Mentor, Pitt/CMU Medical Scientist Training Program
2011 Teaching Assistant, Human Physiology, CMU
2012 Teaching Assistant, Rehabilitation Engineering, CMU
2012 MCAT Instructor in Physics and Chemistry (ExamKrackers, Inc. Pittsburgh, PA)
2013 T32 Fellowship Awardee: Biomechanics in Regenerative Medicine Training Grant
2013 Teaching Assistant, Rehabilitation Engineering, CMU
2014 Graduate Student Assembly Representative, CMU

Professional Society Memberships

Alpha Eta Mu Beta, American Medical Association (AMA), Allegheny County Medical Society, Biomedical Engineering Society (BMES, 2007-2009), Institute for Electrical and Electronics Engineers (IEEE), Engineering in Medicine and Biology Society (EMBS), Society for Neuroscience (2008-2009), Tau Beta Pi

C. Contributions to Science (for predoctoral students and more advanced candidates only; high school students, undergraduates, and postbaccalaureates should skip this section)

My PhD work has been central to developing a flexible, steerable needle that can be navigated in three-dimensions in brain tissue. This technology allows for access of structures deep in the brain while avoiding critical anatomy or vasculature. Applications of this technology include biopsy of suspected lesions, placement of stereotactic tools or electrodes, and distribution of therapeutic agents in complex three-dimensional shape distributions. My work has built upon the needle steering system developed in the lab of Cameron Riviere, which was previously designed to navigate along two-dimensional (planar) paths.

Much of my work has been involved with design of a flexible needle that is safe in contact with brain tissue. Optimal needle design studies were developed with finite element modeling of needle insertion and rotation into a brain tissue model:

Lehocky CA, Shi Y, Riviere CN. "Hyper- and Viscoelastic Modeling of Needle and Brain Tissue Interaction." Conf Proc IEEE Eng Med Biol Soc. 2014;2014:6530-3. PMCID:PMC4359917.

Needle designs that conformed to brain stress, strain and strain rate safety limits were fabricated and investigated for steerability in phantom tissues, and safety studies were conducted *in vivo* to assess tissue damage. The kinematics of the final needle designs were used to develop path-planning algorithms that enable the needle to reach a specified target while avoiding critical segmented anatomy:

Lehocky CA, Xiao Li, Riviere CN. (2012) Design and control considerations for safe needle steering in brain tissue. International Conference on Communications, Computing and Control Applications (CCCA), pp. 1-6. 6-8 Dec. 2012.

With the work of previous graduate student Nathan Wood, we developed a three-dimensional control and state estimation algorithm that steers the needle along pre-planned 3D paths in tissue:

Wood NA, **Lehocky CA***, Riviere CN. (2013) Algorithm for three-dimensional control of needle steering via duty-cycled rotation. IEEE International Conference on Mechatronics (ICM), pp. 237-241. 27 Feb.-1 March 2013. (***: presenting author*)

These three areas are culminating in a safe, flexible needle that can be steered along pre-planned three-dimensional paths in brain tissue. My full bibliography can be accessed at:
https://scholar.google.com/citations?user=E14GpAcAAAAJ&hl=en