

Jacob L. Segil, Ph.D.

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Education

University of Colorado at Boulder August 2010 – May 2014

Doctor of Philosophy, Mechanical Engineering

- Research in Neural Interfaces and Prosthetic Control
- Dissertation title: *Development and Validation of a Postural Controller for Advanced Myoelectric Prosthetic Hands*

University of Colorado at Boulder August 2010 – May 2012

Master of Science, Mechanical Engineering

- Bioengineering track

University of Illinois at Urbana-Champaign August 2003 – May 2008

Bachelor of Science with Honors, Mechanical Engineering

- Minor in Mathematics
- Concentration in Biomedical Engineering

Research Experience

Visiting Post-Doctoral Fellow Cleveland, OH

Functional Neural Interface Laboratory January 2017 - Present

Case Western Reserve University

- Rehabilitation Research and Development *Career Development Award-1*
- ‘Integration of a Sensory Feedback Implant with Myoelectric Prosthetic Hands’
- Visiting fellow during CDA1 summers
- Mentored by Dustin Tyler, Cleveland VAMC

Research Healthcare Scientist Denver, CO

Department of Veterans Affairs January 2017 - Present

- Rehabilitation Research and Development *Career Development Award*
- ‘Integration of a Sensory Feedback Implant with Myoelectric Prosthetic Hands’
- Mentored by Richard Weir and Alena Grabowski, Denver VAMC

Research Assistant (Denver, CO and Chicago, IL)

Biomechatronics Development Laboratory

University of Colorado Denver | Anschutz Medical Campus 2010 - 2016

Rehabilitation Institute of Chicago 2008 – 2010

- Mentor: Dr. Richard F. ff. Weir

Teaching Experience

University of Colorado

Boulder, CO

Teaching Faculty –Engineering Plus program

August 2014 - Present

- Teaching 3-5 undergraduate courses an academic year
- Joint appointment with Mechanical Engineering department (Fall 2014-Fall 2016)
- 16 courses taught to 779 students total
- Median Instructor Overall Score (out of 6): **5.1**
- Median Course Overall Score (out of 6): **4.75**

Industry Experience

Point Designs LLC

Boulder, CO

Founder

June 2016 – Present

- Founded a medical device startup company to manufacture prosthetic components
- Launched first product, the *Point Digit*, a mechanical prosthetic finger for heavy-duty use
- 330% organic year-over-year growth in first two years

Infinite Biomedical Technologies LLC

Baltimore, MD

Consultant

October 2016 - Present

- Chief scientist on *Glide* myoelectric control algorithm project
- Lead author on successful \$1.7million SBIR application
- Grant writer for SBIR/STTR prosthetic technology applications

MITA LLC

Boulder, CO

Founder

July 2015 – Present

- Successful exit when purchased by Stryker Biomedical (October 2016)
- Lead engineer on developed of arthroscopic hip traction frame
- Lead inventor on licensed provisional patent

SparkFun Electronics

Boulder, CO

Engineering Education Consultant

January 2014 – December 2016

- Managed and wrote a SBIR proposal for the NSF education applications track
- Develop a collegiate level Intro to Design course based on GEEN 1400 at CU - Boulder
- Integrate SparkFun products into hands-on teaching curriculum that emphasize mechanical, electrical, and software design.

Federally Funded Research Projects

Current

(2018) VARR&D Contract: Segil (PI) 10/01/2018-9/30/2019
Agency: U.S. Dept. of Veterans Affairs VARR&D
Proximity, Contact, and Force Sensing Finger Tip Material for Cleveland VA Medical Center Clinical Trial
Award Type: Contract
Total Award: \$199,747
Role: **Principal Investigator**
Status: Current

(2017) VARR&D IK1RX002011: Segil (PI) 01/01/2017-12/31/2018
Agency: U.S. Dept. of Veterans Affairs VARR&D
Integration of a Sensory Feedback Implant with Myoelectric Prosthetic Hands
Award Type: Career Development Award 1
Total Award: \$245,953
Role: **Principal Investigator**
Status: Current

(2018) NIH R41 HD096942-01 Segil (Co-I) 10/1/2018 – 04/01/2019
Agency: National Institute of Health – ZRG1 MOSS-V (15)
The Point Partial: A ratcheting prosthetic partial finger using advanced rapid manufacturing technology
Award Type: Phase 1 Small Business Innovative Research (SBIR)
Total Award: \$209,900
Role: **Co- Investigator** (PI: Sliker, Point Designs LLC). I am responsible for overseeing the mechanical design and testing through the UC-Denver subaward.
Status: Current

(2016) NIH R44 HD087065 Segil (Co-I) 09/1/2016 – 08/31/2019
Agency: National Institute of Health – ZRG1 ETTN-C (10)
Joint angle transform based methodology for controlling upper limb prostheses
Award Type: Fast Track Small Business Innovative Research (SBIR)
Total Award: \$1,609,492
Role: **Co- Investigator** (PI: Kaliki, Infinite Biomedical Technologies, LLC). I am the lead researcher for the UC Denver subaward and responsible for patient testing, product design, analysis, and reporting.
Status: Current

(2017) VARR&D I1O1RX002830-01A1 Segil (Co-I) 01/01/2018 – 01/01/2020
Agency: U.S. Dept. of Veterans Affairs VARR&D
Artificial Digit Replacements for Women Veterans with Individual Digit Loss
Award Type: Merit Review
Total Award: \$496,123

Books

1. **J. L. Segil**, *Handbook of Biomechatronics*, 1st ed. Elsevier, 2018. (lead editor)

Journal Publications

1. **J. L. Segil**, S. A. Huddle, and R. F. Weir, “Functional Assessment of a Myoelectric Postural Controller and Multi-Functional Prosthetic Hand by Persons With Trans-Radial Limb Loss,” *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 25, no. 6, pp. 618–627, Jun. 2017.
2. Radhen Patel, **J.L. Segil**, Nikolaus Correll, “Manipulation Using the “Utah” Prosthetic Hand: The Role of Stiffness in Manipulation”, *Robotic Grasping and Manipulation Challenge* (book chapter), pp. 107-116, Oct. 2016.
3. **J. L. Segil** and R.F. Weir “A Novel Architecture for a Postural Controller of Multi-functional Myoelectric Prosthetic Hands.” *Journal of Rehabilitation Research and Development*. 52.4 (2015).
4. **J. L. Segil**, M. Controzzi, R.F. Weir, and C. Cipriani “A Comparative Study of State of the Art Myoelectric Controllers for Multi-Grasp Prosthetic Hands.” *Journal of Rehabilitation Research and Development* 51.9 (2014).
5. C. Cipriani, **J. L. Segil**, F. Clemente, R. F. Weir, and B. Edin. “Discrete Event Sensory Feedback During Teleoperation of a Prosthetic Hand.” *Experimental Brain Research* Volume 232, Issue 11 (2014).
6. C. Cipriani, **J. L. Segil**, J. A. Birdwell, and R. F. Weir. “Dexterous Control of a Prosthetic Hand Using Fine-wire Intramuscular Electrodes in Targeted Extrinsic Muscles.” *Neural Systems and Rehabilitation Engineering, IEEE Transactions On* 22.4 (2014).
7. **J. L. Segil** and R. F. Weir. “Design and Validation of a Morphing Myoelectric Hand Posture Controller Based on Principal Component Analysis of Human Grasping.” *Neural Systems and Rehabilitation Engineering, IEEE Transactions On*. 22.2 (2014).
8. J. T. Belter, **J. L. Segil**, A. M. Dollar, and R. F. Weir. “Mechanical Design and Performance Specifications of Anthropomorphic Prosthetic Hands: A Review.” *Journal of Rehabilitation Research and Development*. 50.5 (2013)
9. **J. L. Segil**, Radhen Patel, John Klinger, Richard Weir, and Nikolaus Correll, “Multi-Modal Fingertip Sensor with Proximity, Contact, and Force Localization Capabilities”, *Advances in Mechanical Engineering*, (accepted for publication)

In review:

1. **J.L. Segil**, Nicholas Kellaris, Shane K. Mitchell, Richard F. Weir, Christoph Keplinger, “Performance Evaluation of First-generation Peano-HASEL Actuators for use in Prosthetic Devices” *IEEE Robotics and Automation Letters (RA-L)*, (in review)
2. **J. L. Segil**, Rahul Kaliki, Jack Uehellendahl, and Richard Weir, “Clinical Readiness of a Myoelectric Postural Control Algorithm for Persons with Trans-radial Amputation,” *Prosthetics and Orthotics International*, (in review)

Peer Reviewed Full-Length Conference Proceedings

1. **J.L. Segil**, Jacquelyn Sullivan, Janet Y. Tsai, Derek T. Reamon, and Marissa H. Forbes, “Investigation of Spatial Visualization Skills Across World Regions”, *IEEE Frontiers in Education Annual Conference*, 5 pages, Indianapolis, Indiana, October 2017
2. **J.L. Segil**, Stephen Huddle, Levin Sliker, Richard F. ff. Weir, “The Point Digit: Mechanical Design and Testing of a Ratcheting Prosthetic Finger”, *American Society of Biomechanics Annual Conference*, 2 pages, Boulder, Colorado, August 2017
3. **J. L. Segil**. And Gill, Emily C. “Let’s Learn about Spatial Visualization”, 12 pages, Published November 21, 2016. Engineering Plus Degree Program, TeachEngineering Digital Library Collection, University of Colorado Boulder, Regents of the University of Colorado. https://www.teachengineering.org/lessons/view/cub_spatviz_lesson01
4. **J.L. Segil**, Jacquelyn Sullivan, Beth A. Myers, Derek T. Reamon, and Marissa H. Forbes, “Analysis of Multi-Modal Spatial Visualization Workshops Intervention across Gender, Nationality, and Other Engineering Student Demographics”, *IEEE Frontiers in Education Annual Conference*, 5 pages, Erie, Pennsylvania, October 2016
5. **J.L. Segil**, Beth Myers, Derek Reamon, Jackie Sullivan, “Efficacy of Various Spatial Visualization Implementation Approaches in a First-Year Engineering Projects Course”, *American Society of Engineering Education Annual Conference*, 7 pages, Seattle June 2015
6. **J.L. Segil**, Brian Huang, Lindsay Levkoff, “Development of a Semester Long High School Introduction to Engineering Design Course for a Prototypical Classroom”, *American Society of Engineering Education Annual Conference*, 4 pages, Seattle June 2015
7. **J.L. Segil**, Brian Huang, Lindsay Levkoff, “Porting a University Introduction to Design Course to a Semester Long High School Course Based on Open-Source Hardware and Arduino”, 4 pages, *American Society of Engineering Education Annual Conference*, Seattle June 2015
8. A. Clawson, **J. L. Segil**, B. Jones, P. Kyberd, Y. Losier, and R. F. Weir “Mechanical Design of a Multifunction Hand Prosthesis System - The UNB Hand”, 4 pages, *International Society for Prosthetics and Orthotics (ISPO) World Congress 2010* (Congress Lecture 3287)
9. P. Kyberd, A. Clawson, B. Jones, Y. Losier, A. Wilson, K. Englehart, **J. L. Segil**, and R. F. Weir “The UNB Hand - Multifunction Hand Prosthesis System”, 4 pages, *International Society for Prosthetics and Orthotics (ISPO) World Congress 2010*

In review:

1. Arjun Fontaine, **J.L. Segil**, John Caldwell, Richard F. ff. Weir, “Real-Time Prosthetic Digit Actuation by Optical Read-out of Activity-Dependent Calcium Signals in the Peripheral Nerve”, 4 pages, *IEEE EMBS Conference on Neural Engineering*, (in review)

Peer Reviewed Conference Abstracts

1. **J.L. Segil**, “Spatial Visualization Workshops for First-Year Engineering Students”, *American Society of Engineering Education Zone IV Conference*, Boulder, CO, March 2018
2. **J.L. Segil**, Stephen Huddle, Levin Sliker, Richard F. ff. Weir, “The Point Digit: A passive, ratcheting prosthetic finger manufactured using metal laser sintering rapid prototyping technology”, *Myoelectric Control Symposium*, Fredericton, New Brunswick, Canada, August 2017
3. **J.L. Segil**, Radhen Patel, Yanyu Xiong, Marie Schmitt, Richard F. ff. Weir, Nikolaus Correll, “Force Sensing Prosthetic Fingertip using Elastomer-Embedded Commodity Infrared Proximity Sensor”, *Myoelectric Control Symposium*, Fredericton, New Brunswick, Canada, August 2017
4. **J.L. Segil**, Jacquelyn Sullivan, Beth Myers, Marissa Forbes, “Multi-Modal Spatial Visualization Workshop for First-Year Engineering Students: A deeper look”, *WEPAN Change Leader Forum*, June 2016
5. **J.L. Segil**, Beverly Louie, Jacquelyn Sullivan, Beth Myers, “Hands-on, Minds-on Spatial Visualization Workshops for First-Year Engineering Students”, *WEPAN Change Leader Forum*, June 2015
6. **J.L. Segil**, Stephen Huddle, Richard F. ff. Weir, “Functional Assessment of Transradial Amputees with a Myoelectric Postural Controller and Multi-functional Prosthetic Hand”, *Myoelectric Control Symposium*, August 2014
7. **J.L. Segil**, R. F. Weir, and C. Cipriani, “Comparison of State of the Art Myoelectric Controllers for Advanced Prosthetic Hands using SHAP Test”, *IEEE EMBS Conference on Neural Engineering*, November 2013.
8. **J. L. Segil** and R. F. Weir, “Derivation of Optimal Surface Electrode Control Sites using Untargeted Electrode Array for Myoelectric Control of Prosthetic Hands”, *Rocky Mountain American Society of Biomechanics – Regional Conference*, March 2013
9. **J. L. Segil** and R. F. Weir, “Design of a Myoelectric Controller for a Multi-DOF Prosthetic Hand based on Principal Component Analysis” *ASME IMECE 2011 Congress - Poster Session Track 24-6*, November 2011
10. **J. L. Segil**, D. Reamon, and R. F. Weir, “Design of a Myoelectric Controller for a Multi-DOF Prosthetic Hand based on Principal Component Analysis”, *Myoelectric Control Symposium 2011*, Fredericton, New Brunswick.

National Awards and Honors

Career Development Award, Department of Veteran Affairs Rehabilitation Research and Development January 2017

Robotics Grasping and Manipulation Competition - Second Place Finish, IEEE/RSJ International Conference on Intelligent Robots and Systems, Team University of Colorado at Boulder Awarded October 2016

Best Student Paper Award, Myoelectric Controls Symposium 2014, New Brunswick, Canada Awarded August 2014

Whitaker International Fellow, Whitaker Program Summer Grant, Institute of International Education (IIE) Awarded June 2013

Emerging Researchers in Biomedical Engineering - *Honorable Mention*, ASME IMECE 2011 Congress - Poster Session Track 24-6 Awarded November 2011

Honorable Mention, National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Awarded March 2011

Honorable Mention, National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Awarded March 2010

Local Awards and Honors

IRT Multi-Functional Materials Seed Grant – Development of Artificial Muscles for Prosthetic Devices using Hydraulically Amplified Self-healing Electrostatic (HASEL) Actuators, College of Engineering, University of Colorado at Boulder (\$5,000) Awarded Summer 2018

IRT Multi-Functional Materials Seed Grant – Multifunctional electronic skins for applications in prosthetics and spacesuits, College of Engineering, University of Colorado at Boulder (\$10,000) Awarded Spring 2018

IRT Multi-Functional Materials Seed Grant – Proximity, Contact, and Force Sensing Prosthetic Finger Tip Material for DARPA HAPTIX Program, College of Engineering, University of Colorado at Boulder (\$5,000) Awarded Winter 2018

Faculty Incentive Award – Spatial Visualization Teach Engineering Curriculum, College of Engineering, University of Colorado at Boulder (\$250) Awarded Fall 2016

Engineering Excellence Fund Award – Spatial Visualization Workshop Improvements, College of Engineering, University of Colorado at Boulder (\$3,730) Awarded Fall 2016

Engineering Excellence Fund Award – Data Analysis Equipment, College of Engineering, University of Colorado at Boulder (\$4,852) Awarded Spring 2016

Patents

1. S. Huddle, **J.L. Segil**, L. Sliker, R. Weir (2018) *Point Partial: A prosthetic partial finger for heavy-duty use*. United States Provisional Patent Application (CU4889D) (**currently licensed to Point Designs LLC**)
2. R. Patel, **J.L. Segil**, J. Klinger, R. Weir, N. Correll, (2018) *Multi-Modal Fingertip Sensor with Proximity, Contact, and Force Localization Capabilities*. United States Provisional Patent Application CU4737B-PPA1 (**currently licensed to Robotic Materials LLC**)
3. O.Y. Mei-Dan and **J.L. Segil**, (2017) *Slotted Canulla for Arthroscopic Surgery*. United States Provisional Patent Application 62/593,663 (**in negotiations with Stryker Inc.**)
4. R. Shandas, O.Y. Mei-Dan, **J.L. Segil**, (2016) *Surgical Table and Accessories to Facilitate Hip Arthroscopy*. United States Provisional Patent Application 009136-8021.US01 (**purchased by Stryker Inc.**)
5. **J. L. Segil**, R. F. Weir, (2013): *Systems and Methods for Postural Control Of A Multi-Function Prosthesis*. International Application No. PCT/US2014/040569 (**currently licensed to Infinite Biomedical Technologies LLC**)

Invited Talks/Presentations

1. **J. L. Segil**, (2018) Just Keep Going, CU Commercialization Academy, Boulder CO 2018
2. **J. L. Segil**, (2018) Biomechatronics Development Laboratory Current Research, SparkFun Lunch and Learn, Boulder CO 2018
3. **J. L. Segil**, (2018) Neural Interfaces and the Biomechatronics Development Laboratory, IEEE Dine and Learn, Denver CO 2018
4. **J. L. Segil**, (2017) How Do Prosthetic Hands Work?, Rogers Park Montessori, Chicago, IL, December 2017
5. **J. L. Segil**, (2017) Brains, Muscles, Nerves, and Prosthetic Limbs, Boulder Country Day School, Boulder, CO, November 2017
6. **J. L. Segil**, (2017) A Review of Upper Limb Prosthetics, ATLAS Seminar on Human-Computer Interface, CU Boulder, November 2017
7. **J. L. Segil**, (2017) CDA1 Research Project: Integration of a Sensory Feedback Implant with Myoelectric Prosthetic Hands, VA Directors Meeting, Denver, CO July 2017
8. **J. L. Segil**, (2017) Integration of a Sensory Feedback Implant with Myoelectric Prosthetic Hands, VA Research Days, Denver, CO May 2017
9. **J. L. Segil**, (2017) Modern Prosthetic Design, Blow Things Up Lab, ATLAS Institute, CU Boulder, April 2017
10. **J. L. Segil**, (2017) IEEE Dine and Learn: Modern Prosthetic Devices, IEEE Denver Community Series, Westminster, CO, January 2017
11. **J. L. Segil**, (2016) Maker Education in a (Nearly) Empty Classroom, Colorado Learning and Teaching with Technology Conference, Boulder, Colorado, August 2016
12. **J. L. Segil**, (2016) IoT: What do Students Need to Learn to be Successful in this Field? Panel: Division Experimentation and Lab-Oriented Studies, American Society of Engineering Education Annual Conference, New Orleans, Louisiana, June 2016

13. **J. L. Segil** (2016) Engi-Near-Me, Broadening Opportunity through Leadership and Diversity (BOLD) program, Boulder, CO, June 2016
14. **J. L. Segil** (2015) Engi-Near-Me, Broadening Opportunity through Leadership and Diversity (BOLD) program, Boulder, CO, June 2015
15. **J. L. Segil**, (2014) Myoelectric Control Systems, BIOE 5073 – Neural Interfaces and Bionic Limbs, Department of Bioengineering, University of Colorado at Denver (2/12/2014)
16. **J. L. Segil**, (2014) Development and Validation of a Postural Controller for Advanced Myoelectric Prosthetic Hands, CEAS Spring Seminar, Department of Mechanical Engineering, University of Colorado at Denver (2/11/2014)
17. **J. L. Segil**, (2013) Pizza, Prostheses, and Pedagogy – A Graduate School Experience, MCEN 5027 – Graduate Seminar, Department of Mechanical Engineering, University of Colorado at Boulder (9/26/2013)
18. **J. L. Segil**, (2013) Skeletal and Muscular Systems and Prosthetic Hands, 8th grade class, Rogers Park Montessori (3/8/2013)
19. **J. L. Segil**, (2012) Skeletal and Muscular Systems and Prosthetic Hands, 7th grade class, Evergreen Middle School, Jefferson County Public School (12/20/2012)
20. **J. L. Segil**, (2012) Introduction to Brain Machine Interface and Myoelectric Control of Prosthetic Hands, MCEN 5117 – Anatomy and Physiology for Engineers, Department of Mechanical Engineering, University of Colorado at Boulder (10/8/2012)

Popular Press

1. “The Mind’s Eye”, American Society of Engineering Education – Prism Magazine, October 2018
2. “Biomedical startup acquired by global medical technology firm”, EurekAlert, May 2018
3. “Case Study: Robotic Materials Enables New Avenues in Prosthetic Research”, Robotic Materials Blog, September 2016
4. “A Helping Hand”, CU Engineering Magazine, April 2016
5. “Spatial Visualization: A Promising Intervention for Promoting Student Equity”, WEPAN Webinar, April 2016
6. “Q&A with Jacob Segil”, SparkFun Blog, November 2015

Student Mentoring

1. Radhen Patel – Doctoral Dissertation Committee, Fall 2016 – current
2. Racheal Ruppretch – GEEN 4848 – Independent Study, “Compliant Fingertip Pad Design for Point Digit”, Fall 2018
3. Jeff Lamon – GEEN 4848 – Independent Study, “Invention and Innovation”, Summer 2018
4. Humsini Acharya – GEEN 4848 – Independent Study, “Influence of Color on Bionic Hand Prosthetic Fingertip Sensor”, Spring 2018
5. Morgan Hoos – MCEN 4848 – Independent Study, “Point Thumb: A prosthetic thumb for heavy-duty use”, Fall 2017

6. Yoni Shapiro – Independent Study, “The HASEL Finger: A proof of concept demonstration”, Summer 2017
7. Marie Schmitt – MCEN 4848 – Independent Study, “Electromechanical Integration of a Prosthetic Hand with Finger Tip Sensors”, Spring 2017
8. Michael Amoun – MCEN 4848 – Undergraduate Independent Study, “Design of an Abduction Drive for a Prosthetic Hand”, Fall 2016
9. Kaiyang Zheng – MCEN 4848 - Undergraduate Independent Study, “Tactile Sensor Integration in a Prosthetic Hand”, Summer 2016
10. Khalia Hogg – MCEN 4848 - Undergraduate Independent Study, “Big Bike Mechanical Design Project”, Fall 2015

Technical Skills

- Software expertise: MATLAB, Solidworks, LabView, Arduino, C/C++, Working Model, Pro/Engineer, MotionAnalysis, Simulink, Microsoft Word, Microsoft Excel, Microsoft Powerpoint
- Hardware expertise: EOS M360 metal laser sintering 3D printer, Objet dual-material plastic 3D printer, Noraxon EMG acquisition system, OptoTrak motion capture system, Vicon motion capture system, Bertec split-belt treadmill, CNC mill, CNC lathe