

CURRICULUM VITAE

LAWRENCE M BOYD

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EDUCATION

Duke University
Durham, North Carolina
Ph.D., Biomedical Engineering
September 2007

Christian Brothers University
Memphis, Tennessee
Master of Engineering Management, May 1993

Clemson University
Clemson, South Carolina
M.S., Bioengineering, December 1989

Clemson University
Clemson, South Carolina
B.S., Mechanical Engineering, December 1987

PROFESSIONAL WORK EXPERIENCE

<i>April 2019 to Present</i>	Vice President, Product Development Bioventus Durham, North Carolina
<i>November 2018 to Present</i>	Professor of the Practice Department of Bioengineering Clemson University Clemson, South Carolina
<i>May 2016 to May 2018</i>	Executive Vice President, Research & Development <i>Spinal Elements</i> Marietta, Georgia
<i>January 2015 to May 2016</i>	Director, Medtown Ventures Atlanta, Georgia and RTP, North Carolina
<i>August 2007 to May 2016</i>	President and Founder Palmetto Biomedical, Inc. (www.palmettobiomedical.com) Columbia, South Carolina & Durham, North Carolina
<i>June 2013 to December 2014</i>	Vice President, Engineering and Business Development <i>Biologics Division, Spine Wave, Inc</i> Shelton, Connecticut and RTP, North Carolina

<i>April 2010 to June 2013</i>	Chief Technical Officer, Bioshape Solutions <i>Research Triangle Park, North Carolina</i>
<i>August 2007 to June 2013</i>	Associate Director, Duke Center for Entrepreneurship and Research Commercialization (CERC); Adjunct Professor, Biomedical Engineering and Engineering Management Duke University, Durham, North Carolina
<i>July 2000 – July 2007</i>	Graduate Research Assistant Duke University, Durham, North Carolina
<i>September 1999 – May 2000</i>	Vice President, Product Development Medtronic Sofamor Danek, Memphis, Tennessee
<i>July 1995 – September 1999</i>	Group Director, Engineering Sofamor Danek Group, Memphis, Tennessee
<i>May 1992 – July 1995</i>	Product Development Manager Sofamor Danek Group, Memphis, Tennessee
<i>September 1989 – May 1992</i>	Product Development Group Leader/Engineer Dow Corning Wright, Arlington, Tennessee

HONORS AND AWARDS

- 2015 College of Fellows, American Institute for Medical and Biological Engineering
- 2007 Dean's Award for Mentoring, Graduate School, *Duke University*
- 2007 Graduate Certificate in Center for Biomolecular & Tissue Engineering, *Duke University*
- 2003 Jeremy North Book Collectors Contest, Graduate Category Award Winner, Friends of the Library, *Duke University*
- 2002 Teaching Grant, Boyd LM, Driscoll S and Mitchell S, "Initiation of a Teaching Engineering Discussion Group for BME Graduate Students", Center for Teaching, Learning and Writing, *Duke University*
- 2001 NIH Pre-Doctoral Fellowship in Cellular and Biosurface Engineering, Center for Cellular and Biosurface Engineering, *Duke University*
- 1987 Tau Beta Pi Engineering Honor Society, *Clemson University*

PROFESSIONAL SERVICE ACTIVITIES

- 2019 Adjunct Professor, Joint Department of Biomedical Engineering, North Carolina State University and University of North Carolina at Chapel Hill
- 2018 SCLaunch Resource Partner, SCRA Academic Collaboration Team & MDCAP Committee Member, South Carolina Research Authority
- 2006 Reviewer, Medical Engineering & Physics and Journal of Biomechanics
- 2005 Session Moderator, *Lumbar Intervertebral Disc Course*, AOSpine, Davos, Switzerland
- 2004 Session Moderator, *Non-fusion Techniques in Spinal Surgery*, Milan, Italy
- 2003 Session Moderator, *Non-fusion Techniques in Spinal Surgery*, Bordeaux, France.
- 2002 Video Clip, *Department of Biomedical Engineering Website*, Duke University
- 1997 Novus LC Interbody Fusion Device Orthopaedic Panel Hearing, *U.S. Food and Drug Administration*, Washington, D.C., December 11
- 1992 Secretary, Memphis *Biomedical Engineering Society*

TEACHING EXPERIENCE

- Instructor, Spring 2009 to June 2013, Introduction to Entrepreneurship Module, Duke Center for International Development, Duke University (Enrollment 30).

- Instructor, Spring 2008 to June 2013, BME 165/EGRMGMT 299, Managing the Design Process and Controlling Risk with Innovative Technologies: Case Studies and Strategies for Engineers and Managers, Duke University (enrollment 10).
- Instructor, Spring 2008, Fall 2009, SOC 192, Independent Study (Market assessment and business plan development), Duke University (Enrollment 2).
- Instructor, Fall 2007 to June 2013, BME 120, Introduction to Business in Technology-based Companies, Duke University (enrollment 30).
- Instructor, Fall 2007 to June 2013, EGRMGMT 299, Leading Multi-functional Teams in Technology-based Companies, Duke University (enrollment 7)
- Guest Lecturer, Fall 2005 to June 2013, BME 227, Biotechnology and Biological Device Design, Duke University
- Instructor, Spring 2005, BME 227, Biotechnology and Biological Device Design, Duke University (enrollment 14)
- Teaching Assistant, 2001 - 2002, BME 083, Introduction to Biomaterials, Duke University (enrollment 45-55)
- Leader, Discussion Group, 2001 – 2002, Teaching Engineering Discussion Group for BME Graduate Students
- Sales Training Instructor, 1994-2000, Medtronic Sofamor Danek, Memphis, Tennessee.

STUDENTS SUPERVISED

- Kyle Smith, BS 2003, Biomedical Engineering, Duke University, Summer 2001 – Fall 2001.
- Nikki Dinola, BS 2004, Biomedical Engineering Undergraduate, North Carolina State University, Summer 2002.
- Alok Tewari, BS 2005, Biomedical Engineering Undergraduate, Duke University, Spring 2003.
- Phebe Ko, BS 2005, Biology Undergraduate, Duke University, Summer 2004.
- Mark Clapp, BS 2007, Biomedical Engineering Undergraduate, North Carolina State University, Spring-Fall 2005.
- Devin Odom, BS 2006, Biomedical Engineering Undergraduate, Duke University, Fall 2005 – Spring 2006.
- Anand Sundaram, BS 2009, Biomedical Engineering Undergraduate, Duke University, Summer 2006, Fall 2007.
- Courtney Horton, MS 2006, Biomedical Engineering, Duke University, Summer/Fall 2006.
- Antonia Helbling, BS 2009, Biomedical Engineering, Duke University, Fall 2006.
- Nga Le, MS 2008, Biomedical Engineering, Duke University, Spring/Summer 2007
- Dana Rosenberg, BS 2008, Biology, Duke University, Spring 2008
- Michael McGroddy, MS 2010, Engineering Management, Duke University, Summer 2010
- Patrick Wedgeworth, MS 2011, Engineering Management, Duke University, Fall 2010 – Fall 2011
- Phoenix Pei, MS 2013, Engineering Management, Duke University, Fall 2012 - Spring 2013
- Isaac Odum, MEng 2013, Biomedical Engineering, Duke University, Summer 2013
- Kyle Langdell, BS 2014, Biomedical Engineering, Duke University, Spring 2014
- Cooper Eben, MEng 2015, Biomedical Engineering, Duke University, Summer 2014
- Adam McKenzie, BS 2015, Biomedical Engineering, Georgia Tech, Summer 2015
- Shuja Rayaz, MEng 2017, Biomedical Engineering, Duke University, Summer 2016
- Christopher Silva, MS 2017, Biomedical Innovation & Development, Georgia Tech, Summer 2017

PROFESSIONAL AFFILIATIONS

North American Spine Society
 Orthopaedic Research Society
 Biomedical Engineering Society
 American Society for Engineering Education

CONSULTING

<i>September 2007 – June 2010</i>	Nuvasive, Inc., San Diego, California
<i>June 2002 – January 2015</i>	Spine Wave, Inc. Shelton, Connecticut

May 2000 – May 2002

Medtronic Sofamor Danek, Memphis, Tennessee

May 2018 to April 2019

Spinal Elements, Carlsbad, California

November 2018 to April 2019

Cerapedics, Westminster, Colorado

PEER-REVIEWED JOURNAL ARTICLES AND FULL-LENGTH PUBLICATIONS

Allen KD, Griffin TM, Rodriguez RM, Wetsel WC, Kraus VB, Huebner JL, Boyd LM and LA Setton (2009) Decreased Physical Function and Increased Pain Sensitivity in Mice Deficient for Type IX Collagen. *Arthritis & Rheumatism* 60:9, 2684-2693.

Boyd LM, Richardson WJ, Allen KD, Flahiff C, Jing L, Li Y, Chen J and LA Setton (2007) Early Onset Degeneration of the Intervertebral Disc and Vertebral Endplate in Mice Deficient in Type IX Collagen. *Arthritis & Rheumatism*,58:1, 164-171.

Boyd LM and Carter AJ: (2006) Injectable Biomaterials and Vertebral Endplate Treatment for Repair and Regeneration of the Intervertebral Disc. *European Spine Journal*, 15(Suppl.3):S414-S421.

Kitchel SH, Boyd LM and AJ Carter (2006) NuCore Injectable Disc Nucleus, *Dynamic Reconstruction of the Spine*, Ed: Kim DH, Cammisa FP and RG Fessler, Thieme Medical Publishers, New York, pp. 142-145.

Boyd LM, Richardson WJ, Chen J, Kraus VB, Tewari A and Setton LA: (2005) Osmolarity Regulates Gene Expression in Intervertebral Disc Cells Quantified with Gene Array and Real-time Quantitative RT-PCR. *Annals of Biomedical Engineering*. 33:8, 1071-1077.

Boyd LM, Walkenhorst, J and Carter AJ: (2004) Injectable Biomaterials for Repair and Regeneration of the Intervertebral Disc. *Non-fusion Techniques in Spinal Surgery*, Milan, Italy, September 10-11, 33-41.

Boyd LM, Chen J, Kraus, VB and Setton LA: (2004) Conditioned Medium Regulates Matrix Protein Gene Expression in Cells of the Intervertebral Disc. *Spine* 29:20, 2217-2222.

Boyd LM, Setton LA, Plouhar PL, Hsu ES, and Richardson WJ: (2003) Animal Models of Disc Degeneration: An Experimental Vertebral Body Defect Model for Human Degenerative Disc Disease. *Non-fusion Techniques in Spinal Surgery*, Bordeaux, France, February 14-15, 55-63.

Boyd LM, Mahar A, and Cappello, J: (2003) Injectable Biomaterials for Augmentation of the Nucleus Pulposus. *Non-fusion Techniques in Spinal Surgery*, Bordeaux, France, February 14-15, 83-92.

Cizek G and Boyd LM: (2000) Imaging Pitfalls of Interbody Spinal Implants. *Spine*, 25(20): 2633-2636.

Boyd LM, Estes BT and Liu M: (1999) Biomechanics of Lumbar Interbody Constructs – Effects of Design and Materials. *Chirurgie Endoscopique et Mini-Invasive du Rachis*, Ed: LeHeuc JC and Husson JL, Sauramps Medical Publishing, Montpellier, France, 181-192.

Bouquet P, Boyd LM, Estes BT and Qui Y: (1997) Biomechanical Testing of Interbody Fusion Devices. *Restabilisation Inter-Somatique du Rachis*, Ed: Husson JL and LeHuec JC, Sauramps Medical Publishing, Montpellier, France, pp.75-79.

Boyd LM, Heimke G, Vaughan CL and von Recum AF: (1991) An Investigation of Skin Deformation Around Percutaneous Devices. *Clinical Materials* 7:209-217.

PEER-REVIEWED ABSTRACT PROCEEDINGS

Tally W and LM Boyd (2016) A Novel Cellular Bone Matrix in Spine Fusion: Safety Profile and Early Clinical Outcomes. International Society for the Advancement of Spine Surgery, April 6-8, Las Vegas, NV, Poster 758-0000-00128.

- Lonner B, R Banco, R Paxson and LM Boyd (2012) How Does Design and Implantation Technique Effect Load Distribution for Different Lateral Spinal Implants? International Meeting on Advanced Spine Technique, July 18-21, Istanbul, Turkey, Poster ID 671.
- Boyd LM (2009) Interdisciplinary Education in Engineering Entrepreneurship – Stimulating Innovation and Supporting Entrepreneurial Endeavors on the University Campus. National Collegiate Inventors & Innovators Alliance, March 19-21, Washington, D.C., Poster.
- Chen J, Boyd LM, Allen KD, Tsuboyama M, L Jing, Malfait A-M and LA Setton (2007) Evaluation of Intervertebral Disc and Vertebral Endplate Degeneration in ADAMTS5 (Aggrecanase-2) Knockout Mice. Osteoarthritis Research Society International World Congress, December 6-9, Ft. Lauderdale, Florida.
- Boyd LM, Richardson WJ, Odom D, Flahiff CM, Li Y, Guilak F and LA Setton (2007) Microcomputed Tomographic Analysis of Endplate and Vertebral Body Structure in Mice Lacking Type IX Collagen. *International Society for Study of the Lumbar Spine*, Hong Kong, China, June 10-14, paper 26.
- Boyd LM, Richardson WJ, Allen K, Flahiff CM, Li Y, Guilak F and LA Setton (2007) Early Onset Degeneration of the Intervertebral Disc and Endplate in Mice Deficient in Type IX Collagen. *International Society for Study of the Lumbar Spine*, Hong Kong, China, June 10-14, paper 27.
- Boyd LM, Clapp M, Richardson WJ, Odom DC, Jing L, Chen J, and LA Setton (2007) Static Compression Effects on Region-specific Gene Expression in the Murine Intervertebral Disc In Vitro. *53rd Annual Orthopaedic Research Society*, San Diego, CA, February 11-14, paper 1109.
- Boyd LM, Clapp M, Richardson WJ, Odom D, Jing L, Chen J and Setton LA. (2006) Static Compression Modulates Gene Expression in the Murine Intervertebral Disc In Vitro. *15th World Congress in Biomechanics*, July 29-August 4, p.6757.
- Odom DC, Boyd LM and LA Setton (2006) Evaluation of Bone and Marrow Architecture in Type IX Collagen Deficient Mice Using Microcomputed Tomography. *Biomedical Engineering Department Graduation with Distinction Presentation*, Duke University, April 28.
- Chen J, Jing L, Boyd LM and LA Setton (2006) Intervertebral Disc Cells Respond to Pro-inflammatory cytokine, TNF- α in a Mouse Motion Segment Culture System, *Orthopaedic Research Society*, Chicago, IL, March 19-22, Paper 375.
- Vishnubhotla S, Goel VK, Shaw MN, Sairyo K, Walkenhorst J and LM Boyd (2006) Kinematic Analysis of Dynamic Stabilization Systems for the Lumbar Spine, *Orthopaedic Research Society*, Chicago, IL, March 19-22, Paper 1278.
- Clapp M, Boyd LM, Richardson W, Odom D, Jing L, Chen J and L A Setton (2005) Development of an In Vitro Culture System for Compressive Loading of Intervertebral Discs of the Murine Spine. *State of North Carolina Undergraduate Research Symposium*, Raleigh, NC, November 12.
- Boyd LM, Richardson WJ, Li Y, Chen J, Flahiff CM, Alexopoulos LG, Guilak F, Xu L, Olsen BR, Bonaldo P and Setton LA (2005) Intervertebral Disc Degeneration in Mice Harboring Collagen Gene Mutations. *International Society for Study of the Lumbar Spine*, New York, NY, May 10-14, p. 224.
- Chen J, Jing LF, Boyd LM and Setton LA. Intervertebral Disc Cell Responses to Inflammatory Stimuli in a Mouse Motion Segment Culture System In Vitro (2005) *International Society for Study of the Lumbar Spine*, New York, NY, May 10-14, p. 72.
- Chen J, Jing LF, Boyd LM, Upton ML and Setton LA. Cell Viability and Matrix Protein Gene Expression Levels are Maintained in Mouse Motion Segment Culture (2005) *International Society for Study of the Lumbar Spine*, New York, NY, May 10-14, p.231.
- Vishnubhotla S, Goel VK, Walkenhorst J, Boyd LM, Vadapilli S and Shaw MN. Biomechanical Advantages of Using Dynamic Stabilization Over Rigid Stabilization (2005) *International Society for Study of the Lumbar Spine*, New York, NY, May 10-14, p.426.

- Vishnubhotla S, Goel VK, Walkenhorst J, Boyd LM, Vadapalli S, Shaw MN and Sairo K. Stability Offered by an Interspinous Device in Decompression Surgery – A Biomechanical FEM Study (2005) *International Society for Study of the Lumbar Spine*, New York, NY, May 10-14, p.427.
- Boyd L, Richardson WJ, Li Y, Flahiff CM, Alexopoulos LG, Guilak F, Xu L, Olsen BR, Bonaldo P and Setton LA (2005) Evaluation of Intervertebral Disc Degeneration in Mice Harboring Gene Mutations for Types VI, IX and XI Collagens. *Orthopaedic Research Society*, Washington D.C., February 20-23, Paper 374.
- Vishnubhotla S, Goel VK, Vadapalli S, Masuda A, Khandha A, Shaw MN, Walkenhorst J, and L Boyd (2004) Dynamic Fixation Systems Compared to the Rigid Spinal Instrumentation – A Finite Element Investigation. *American Society of Biomechanics*, Portland, OR, September 8-11.
- Ko, P and L Boyd (2004) Gene Expression in Pediatric Intervertebral Disc Cells Quantified with Gene Array and Real-time Quantitative RT-PCR. *Howard Hughes Summer Scholars*, Poster Session, Duke University, July 30.
- Boyd L, Richardson WJ, Chen J, Kraus VB, and LA Setton (2004) Differences in Expression of Neurotrophic Factors in Adult and Juvenile Intervertebral Disc Cells Subjected to Hyperosmotic Load. *International Society for Study of the Lumbar Spine*, Porto, Portugal, May 30-June 5, p133.
- Boyd LM, Walkenhorst J, and Cappello J: (2004) An Injectable Biomaterial for Augmentation of the Nucleus Pulposus. *Southeast Workshop on Tissue Engineering and Biomaterials*, Clemson University, Clemson, SC, January 29-20.
- Boyd LM, Chen J, Richardson WJ, Kraus VB, and Setton LA: (2003) Increased Expression of Brain-Derived Neurotrophic Factor in Intervertebral Disc Cells Subjected to Hyperosmotic Loading. *International Society for Study of the Lumbar Spine*, Vancouver, Canada, May 13-17, p188.
- Boyd LM, Chen J, Richardson WJ, Kraus VB and Setton LA: (2003) Osmolarity Regulates Gene Expression in Intervertebral Disc Cells Quantified with High Density Oligonucleotide Array Technology. *Transactions of the 49th Annual Meeting of the Orthopaedic Research Society*, New Orleans, LA, February 2-5, 28:1133.
- Boyd LM, Richardson WJ, Kim J, Plouhar PL, Smith KL, Flahiff CM, Malaviya P, Serhan H, Hsu EW and Setton LA: (2002) Experimental Intervertebral Disc Degeneration Induced by a Vertebral Body Defect. *North American Spine Society*, Montreal, Canada, October 29-November 2, p50.
- Boyd LM, Richardson WJ, Kim J, Plouhar PL, Smith KL, Flahiff CM, Malaviya P, Serhan H, Hsu EW and Setton LA: (2002) Vertebral Body Damage Induces Intervertebral Disc Degeneration in an Animal Model. *International Society for the Study of the Lumbar Spine*, Cleveland, OH, May 14-18, p22.
- Boyd LM, Chen J and Setton, LA: (2002) Conditioned Medium Stimulates Aggrecan and Collagen Type II Gene Expression in Anulus Fibrosus Cells. *Transactions of the 48th Annual Meeting of the Orthopaedic Research Society*, Dallas, TX, February 10-13, 27:819.
- Boyd LM, Grinstaff MW, Smeds KA, Betre H and Setton LA: (2001) Development of a Photocrosslinkable Hyaluronan Hydrogel for Cartilage Repair. *Annals of Biomedical Engineering, BMES Meeting Abstract Supplement*, Durham, NC, October 4-7, 29:S1:160.
- Baer AE, Grinstaff MW, Smeds KA, Boyd LM and Setton LA: (2001) Nonlinear Finite Element Modeling of Cell Mechanical Environment in Hydrogels for Intervertebral Disc Repair. *Transactions of the American Society of Mechanical Engineers*, 50:113-114.
- Branch CL, Rauschnig W, Liu M and Boyd LM: (2000) Development and Testing of a Novel Cortical Allograft Wedge for Posterior Lumbar Interbody Fusion. *AANS/CNS Section on Disorders of the Spine and Peripheral Nerves*, Palm Springs, CA, February 23-26, p57.
- Cizek G and Boyd LM: (1999) Imaging Pitfalls of Interbody Spinal Implants. *North American Spine Society*, Chicago, IL, October 21-23, 15-17.
- Cizek G and Boyd LM: (1999) Peri-implant Lucencies due to Radiographic Technical Factors. *North American Spine Society*, Chicago, IL, October 21-23, 17-18.

- Boyd LM, Estes BT and Liu M: (1999) Biomechanical Characteristics of Interbody Constructs: Testing of Titanium, Cortical Bone and Composite Implants. *International Meeting on Advanced Spine Techniques*, Vancouver, Canada, July 8-10.
- Boyd LM, Estes BT, Bianchi JT and Sutterlin CE: (1999) Biomechanical Characteristics of a Novel Threaded Cortical Bone Dowel. *American Association of Tissue Banks*, New Orleans, LA, August 23-25.
- Boyd LM: (1998) Threaded Construct Testing. *International Meeting on Advanced Spine Techniques*, Sorrento, Italy, May 1-3.
- Boyd LM: (1997) Design and Testing of an Intervertebral Disc Prosthesis. *Proceedings 19th International Conference IEEE/EMBS*, Chicago, IL, November 2, 2630-2635.
- Kitchel SH, Estes BT and Boyd LM: (1997) Threaded Cortical Bone Dowels: Biomechanical Properties and Early Clinical Results. *North American Spine Society*, New York, NY, October 22-25, p29.
- Kitchel SH and Boyd LM: (1997) Improvement in Sagittal Plane Alignment Following Anterior Lumbar Interbody Fusion with Threaded Titanium Cages. *North American Spine Society*, New York, NY, October 22-25, 108-109.
- Kitchel SH, Estes BT and Boyd LM: (1997) Threaded Cortical Bone Dowels: Biomechanical Properties and Early Clinical Results. *European Spine Society*, Kos, Greece, September 10-13.
- Estes BT and Boyd LM: (1997) Mechanical Characteristics and Evaluation of a Novel Threaded Cortical Dowel. *International Meeting on Advanced Spine Techniques*, Hamilton, Bermuda, July 10-12..
- Boyd LM, Estes BT and Ray EF: (1996) Biomechanical Testing of Interbody Fusion Devices. *International Meeting on Advanced Spine Techniques*, Munich, Germany, June 20-22.
- Boyd LM and Estes BT: (1995) Biomechanical Testing of Interbody Fusion Devices. *International Meeting on Advanced Spine Techniques*, Curacao, Netherlands Antilles, April 27-28.

INVITED LECTURES

- “The Startup Journey – An Entrepreneurial Adventure”, Graduate Program in Bioengineering, Georgia Institute of Technology, December 17, 2018.
- “Patents & the Individual Inventor”, LAWS 722 - Patent Law Course, University of South Carolina School of Law, November 27, 2018.
- “Adventures in Biomedical Engineering – Industry, Academia and Startups”, Graduate Biomedical Engineering Students (BBUGS-LIFE), Georgia Institute of Technology, September 20, 2017.
- “Careers in Biomedical Engineering”, Masters of Biomedical Innovation and Development, Georgia Institute of Technology, March 3, 2017.
- “Medical Device Entrepreneurship”, Biomedical Engineering 4908, Florida International University, Miami, Florida, February 18, 2015.
- “Entrepreneurship and Intellectual Property”, Business Oriented Women Monthly Meeting, Duke University, November 17, 2014.
- “Entrepreneurship and the Joy of Engineering”, Biomedical Engineering 3101, University of Connecticut, Storrs, September 26, 2013, Duke University – Research Experience for Undergraduates, June 18, 2014 and University of Virginia Capstone Design Class, September 9, 2014.
- “Inventive Drawing”, Visual Arts 100.02 – Drawing, Duke University, Durham, NC, October 5, 2011.
- “Interacting with the Private Sector”, Conference on Communicating Science, Greenville, SC, November 4, 2010.
- “Entrepreneurial Activities in BME”, Southeast Biomedical Engineering Career Conference, Clemson, SC, October 29, 2010.

“Risk Management: An Engineering Perspective”, Fuqua School of Business, Health Sector Management Advisory Council, Durham, NC, April 23, 2010.

“Intervertebral Disc Repair and Regeneration” Nuvasive Inc. Board of Directors, Science and Technology Committee, San Diego, CA, February 22, 2010.

“How to Start a Medical Device Company”, Duke Entrepreneurship Education Series, October 22, 2009.

“DUhatch Student Business Incubator”, Global Consortium of Entrepreneurship Centers, Rice University, Houston, TX, October 15-17, 2009.

“Intellectual Property Basics in Under an Hour”, Duke Entrepreneurship Education Series (www.dukedeeds.com), December 4, 2008.

“Writing a Business Plan”, One Day Startup, Entrepreneurship Week at Duke University (www.eweekatduke.com), November 22, 2008.

“Interdisciplinary Education in Engineering Entrepreneurship”, University of Toledo, Department of Biomedical Engineering, September 12, 2008.

“Stimulating Innovation and Entrepreneurial Endeavors: An Educational Model”, Cleveland Clinic, Department of Neurological Surgery, November 9, 2007.

“The Business World – A Game Plan for Your First Year (and Beyond)”, Graduate Seminar, Department of Biomedical Engineering, Duke University, February 13, 2006.

“Industry, Start-ups and Litigation- Real World Experience”, Graduate Seminar, Department of Biomedical Engineering, Duke University, March 25, 2005.

“Osmotic Regulation of Gene Expression in Intervertebral Disc Cells”, Lumbar Intervertebral Disc Course, AOSpine European Region, Davos, Switzerland, March 17-20, 2005.

“The Role of the Endplate in IVD Degeneration”, Lumbar Intervertebral Disc Course, AOSpine European Region, Davos, Switzerland, March 17-20, 2005.

“Injectable Biomaterials for Repair and Regeneration of the Intervertebral Disc”, Lumbar Intervertebral Disc Course, AOSpine European Region, Davos, Switzerland, March 17-20, 2005.

“Osmolarity Regulates Gene Expression in Intervertebral Disc Cells Quantified with High Density Oligonucleotide Arrays, Real-time Quantitative RT-PCR and ELISA”, Department of Biomedical Engineering, University of Toledo, Toledo, OH, January 23, 2004.

“Intervertebral Disc Repair and Regeneration”, Neurosurgery Grand Rounds, Wake Forest University, Winston-Salem, NC, April 22, 2003,.

“Altered Gene Expression of Intervertebral Disc Cells in Response to Osmolarity Changes”, Center for Biomolecular and Tissue Engineering, Duke University, Durham, NC, April 3, 2003.

“Developing a System for Repair and Regeneration of the Intervertebral Disc”, Elon University, Elon, NC, February 21, 2003.

“Biomechanics of Anterior Cages: Threaded and Upright”, The Surgical Management Disorders, Beaver Creek, CO, January 17, 1999.

“Demineralized Bone Matrix – Background, In Vivo Studies and Clinical Experience”, Clinical Update: Lumbar Interbody Fusion 1997 and Beyond, Seattle, WA, November 15, 1997

“Biomechanical Testing of Interbody Fusion Constructs”, Clinical Update: Lumbar Interbody Fusion 1997 and Beyond, Seattle, WA, November 15, 1997

“Medical Devices: Product Development Process”, Clinical Biomechanics of the Spine Course Lecture, University of Iowa, Iowa City, IA, March 18, 1997.

“Interactions with Students at Sofamor Danek”, Workshop on Industrial Interactions, Biomedical Engineering Society, Pennsylvania State University, State College, PA, October 4, 1996.

“Biomechanical Testing of Interbody Fusion Devices”, Total Spine: Advanced Concepts and Constructs, Cancun, Mexico, February 1, 1995.

“Design Rationale and Biomechanical Testing of Interbody Fusion Devices”, Total Spine: Advanced Concepts and Constructs, Cancun, Mexico, January 27, 1995.

“Spine Disc Prostheses”, Graduate Seminar in Biomedical Engineering, Department of Biomedical Engineering, University of Iowa, Iowa City, IA, September 1, 1994.

PUBLISHED DATA SETS

Boyd LM, Richardson WJ, Chen J, Kraus VB and LA Setton (2004) Osmotic Loading of Human Intervertebral Disc Cells, NCBI Gene Expression Omnibus Accession Number GSE 1648 (<http://www.ncbi.nlm.nih.gov/projects/geo/query/acc.cgi?acc=GSE1648>) , August 7.

PATENTS

Boyd LM and JJ Ratcliffe (2019) Adjustable Surgical Light Device, U.S. Patent D841,209, February 19

Boyd LM, JJ Ratcliffe, J Morin, S Marigowda, TE Adamson, D Robbins and TJ Barbieri (2018) Minimally Invasive Posterolateral Fusion, U.S. Patent 10,022,172, July 17.

Boyd LM, JJ Ratcliffe, TE Adamson and PJ Grata (2017) Instrument and System for Placing Graft, Implant and Graft Material for Minimally Invasive Posterolateral Fusion, U.S. Patent 9,775,723, October 3.

Boyd LM, Adams SB, Penny MR and C Blazek (2017) Device and Method for Delivery of Therapeutic Agents via Internal Implants, U.S. Patent 9,642,658, May 9.

Boyd LM (2013) System and Method for Pretreatment of the Endplates of an Intervertebral Disc, U.S. Patent 8,450,288, May 28.

Kozak J, Estes BT and LM Boyd (2013) Anterior Lumbar Plate and Method, U.S. Patent 8,617,224, Issued December 31.

Collins K, Wilson TG, Walkenhorst J, Lee D, Carter A, Pafford J, LoGuidice M, Middleton L and LM Boyd (2013) Methods for Injecting a Curable Biomaterial into an Intervertebral Space, U.S. Patent 8,444,694, May 21.

Boyd, LM, Burkus JK, Dorchak JD, Estes BT and EF Ray, III (2011) Intervertebral Spacers with Side Wall Accessible Interior Cavity, U.S. Patent 8,038,714, Issued October 18.

Kozak J, Estes BT and LM Boyd (2011) Anterior Lumbar Plate and Method, U.S. Patent 8,016,863, Issued September 13.

Foley K, Ebner H, Liu M, Branch C and LM Boyd (2011) Expandable Intervertebral Spacers, U.S. Patent 7,993,403, August 9.

Boyd LM and ML Upton (2011) Devices and Methods for the Restoration of the Spinal Disc, U.S. Patent 7,914,537, Issued March 29.

Boyd LM, Kirvin D, and SB Adams (2011) Protective and Cosmetic Covering for External Fixators, U.S. Patent 7,887,495, Issued February 15.

Boyd LM (2010) System and Method for Pretreatment of the Endplates of an Intervertebral Disc, Issued September 21.

Collins K, TG Wilson, J Walkenhorst, D Lee, A Carter, J Pafford, MD LoGuidice, L Middleton and LM Boyd (2010) Methods for Treating Defects and Injuries of an Intervertebral Disc, U.S. Patent 7,740,660, Issued June 22.

Collins K, LM Boyd, A Carter, D Lee, J Pafford, J Walkenhorst, TG Wilson, M LoGuidice and L Middleton (2010) Devices for Injecting a Curable Biomaterial into a Intervertebral Space, U.S. Patent 7,722,579, Issued May 25.

Bianchi JR, KC Carter, BT Estes, L Boyd and J A Pafford (2010) Open Intervertebral Spacer, U.S. Patent 7,678,149, Issued March 16.

Boyd LM and ML Upton (2009) Devices and Methods for the Restoration of the Spinal Disc, U.S. Patent 7,601,157, Issued October 13.

Collins K, Wilson TG, Walkenhorst J, Lee D, Carter A, Pafford J, LoGuidice MD, Middleton L and L Boyd (2009) Methods for Injecting a Curable Biomaterial into an Intervertebral Space, U.S. Patent 7,556,650, Issued July 7.

Boyd LM, Burkus JK, Dorchak JD, Estes BT and EF Ray (2009) Intervertebral Spacers with Side Wall Accessible Interior Cavity, U.S. Patent 7,534,265, Issued May 19, 2009.

Branch CL, Liu M, Boyd LM and L Josse (2009) Interbody Fusion Grafts and Instrumentation, U.S. Patent 7,479,160, Issued January 20, 2009.

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