

NIH BIOGRAPHICAL SKETCH

NAME Virginia L. Ferguson		POSITION TITLE Assistant Professor	
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
University of Colorado at Boulder	B.S.	1993	Mechanical Engineering
University of Colorado at Boulder	M.S.	1998	Mechanical Engineering
University of Colorado at Boulder	Ph.D	2001	Mechanical Engineering
Queen Mary, University of London (QMUL) with joint appt. at University College London (UCL)	Post-Doc	2001-2003	QMUL, Materials Science and Engineering; UCL, Dept. of Anatomy and Developmental Biology)
University of Colorado at Boulder	Post-Doc	2003-2005	BioServe Space Tech.; Aerospace Engineering

A. Positions and Honors.

Positions and Employment

- 1/06 – Present Assistant Professor; Mechanical Engineering, University of Colorado, Boulder, CO
 1/03 – Present Visiting Research Associate; Materials Science, Queen Mary, University of London, UK
 3/03 – 12/06 Research Assistant Professor (by courtesy); Colorado School of Mines, Golden, CO
 2/03 – 12/05 Research Associate; BioServe Space Technologies / Aerospace Engineering Sciences University of Colorado, Boulder, CO
 8/03 – 12/04 Adjunct Professor; Mechanical Engineering, University of Colorado, Boulder, CO
 6/01 – 12/02 Postdoctoral Research Associate; Materials Science, Queen Mary, University of London, UK
 6/01 – 12/02 Honorary Research Fellow; Anatomy and Developmental Biology, University College London, UK

Awards and Honors

- 2011 NSF CAREER Award, GARDE Program
 2010 Chancellor's Faculty Award for Excellence in STEM Education for "Assessing YOU'RE@CU: A New Program to Promote Diversity in Engineering"
 2007 Junior Faculty Development Award; Council on Research and Creative Work; Univ. of Colorado
 2006 CU Leadership, Excellence, Achievement, and Diversity Alliance (LEAD) Faculty Appreciation Award.
 2006 Seed Grant; Council on Research and Creative Work; Univ. of Colorado
 2001– Sigma Xi Scientific Honor Society
 2001–2002 Postdoctoral Fellowship, UK Medical Research Council, Discipline Hoppers Scheme
 1999 Best Poster Award, Rocky Mountain Bioengineering Symposium
 1998 Conference Travel Grant, University of Colorado
 1996–1997 University Fellowship, University of Colorado Graduate School

B. Selected peer-reviewed publications (in chronological order, § indicates publications from PI as an independent investigator).

- § Paietta RC, Olesiak SE, Ferguson VL. Influences of spherical tip radius, contact depth and contact area on nanoindentation properties of bone. *Journal of Biomechanics*. 44(2): 285-290, 2011.
- § Olesiak SE, Sponheimer M, Eberle JJ, Oyen ML, Ferguson VL. Nanomechanical properties of modern and fossil bone. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 289(1-4):25-32, 2010.
- § Hanson AM, Stodieck LS, Cannon CMA, Simske SJ, Ferguson VL. Seven days of muscle re-loading and voluntary wheel running following hindlimb suspension in mice restores running performance, muscle morphology and metrics of fatigue but not muscle strength. *Journal of Muscle Research and Cellular Motility*. 31(2):141-53, 2010.

4. § Martino CF, Perea H, Hopfner U, Ferguson VL, Wintermantel E. Effects of Weak Static Magnetic Fields on Endothelial Cells. *Bioelectromagnetics*. 31(4): 296-301, 2010.
5. § Lloyd SA, Yuan YY, Simske SJ, Rifle SE, Ferguson VL, Bateman TA. Administration of high-dose macrophage colony-stimulating factor increases bone turnover and trabecular volume fraction. *Journal of Bone and Mineral Metabolism*. 27:546-554, 2009.
6. § Ferguson VL and Olesiak SE. Nanoindentation of Bone in *Handbook of Nanoindentation with Biological Applications*. World Scientific Press. Editor: Oyen ML. 2010. ISBN-13: 978-9-814-24189-2
7. § Ferguson VL. Deformation partitioning provides insight into elastic, plastic, and viscous contributions to bone material behavior. *Journal of the Mechanical Behavior of Biomedical Materials*. 2:364-374; 2009.
8. § Ferguson VL and Dodson RB. Bioengineering aspects of the umbilical cord. *European Journal of Obstetrics and Gynecology and Reproductive Biology*. 144 Suppl 1:S108-13, 2009.
9. § Ortega MT, Pecaut MJ, Gridley DS, Stodieck LS, Ferguson VL, Chapes SK. Shifts in Bone Marrow Cell Phenotypes Caused by Space Flight. *Journal of Applied Physiology*. 106(2):548-5, 2009.
10. § Gridley DS, Slater JM, Luo-Owen X, Rizvi A, Chapes SK, Stodieck LS, Ferguson VL, Pecaut MJ. Spaceflight Effects on T Lymphocyte Distribution, Function and Gene Expression. *Journal of Applied Physiology*. 106(1):194-202, 2009
11. § Oyen ML and Ferguson VL, Bone as a Composite Material in *Biomechanics of Hard Tissues: Modelling – Testing - Materials*, Ed. A. Oechsner (Wiley-VCH). 2009. (Book Chapter)
12. Ferguson VL, Bushby AJ, Firth EC, Howell PG, Boyde A. Exercise does not affect stiffness and mineralisation of third metacarpal condylar subarticular calcified tissues in 2 year old thoroughbred racehorses. *European Cells and Materials*. 17;16:40-6; discussion 46, 2008.
13. Oyen ML, Ferguson VL, Bembey AK, Bushby AJ, Boyde, A. Composite bounds on the elastic modulus of bone. *Journal of Biomechanics*. 41(11):2585-8, 2008.
14. § Ayers RA, Ferguson VL, Belk D, Moore, J. Self-propagating high-temperature synthesis of porous nickel-titanium. *Materials Science Forum*, 561-565:1643-1648; 2007.
15. § Martino CM, Belchenko D, Ferguson V, Nielsen-Preiss S, Qi HJ. The effects of pulsed electromagnetic fields on the cellular activity of SaOS-2 cells. *Bioelectromagnetics*. 29:125-132; 2007.
16. Bembey AK, Bushby AJ, Boyde A, Ferguson VL, Oyen ML. Hydration effects on the micro-mechanical properties of bone. *Journal of Materials Research*. 21:1962-1968, 2006.
17. § Ayers RA, Nielsen-Priess S, Ferguson V, Gotolli G, Moore JJ, Kleebe HJ. Multiphasic calcium phosphate induced mineralization in SaOS-2 osteoblast-like cells. *Materials Science and Engineering C*. 26:1333-1337, 2006.
18. Bushby AJ, Ferguson VL, Boyde A. Nanoindentation of bone: comparison of specimens tested in liquid and embedded in PMMA. *Journal of Materials Research*, 19:249-259; 2004.
19. Ferguson VL, Ayers RA, Bateman TA, Simske SJ. Characterization of bone development and age related bone loss in male C57BL/6J mice. *BONE*, 33:387-98; 2003.
20. Ferguson VL, Bushby AJ, Boyde A. Nanomechanical properties and mineral concentration in articular calcified cartilage and subchondral bone. *Journal of Anatomy*, 203:191-202; 2003.
21. Simske, SJ, Ferguson, VL, Bateman, TA. Mice and osteoporosis research in *Recent Research Developments in Biotechnology and Bioengineering*, Editor: Pandalai, SG (ed.), vol. 5, pp. 97-127, Research Signpost, Kerala, India; 2003. ISBN: 81-271-0011-0.
22. Halloran BP, Ferguson VL, Simske SJ, Burghardt A, Venton LL, Majumdar S. Changes in bone structure and mass with advancing age in the male C57BL/6J Mouse. *Journal of Bone and Mineral Research*, 17:1044-50; 2002.
23. Ferguson VL, Simske SJ, Ayers RA, Bateman TA, Bendele AM, Colagiovanni DB. Effect of MPC-11 myeloma and MPC-11 + IL-1ra treatment on mouse bone properties. *BONE*, 30:109-116; 2002.
24. Bateman TA, Dunstan CR, Lacey DL, Ferguson VL, Simske SJ. Osteoprotegerin ameliorates sciatic nerve crush induced bone loss. *Journal of Orthopaedic Research*, 19:518-523; 2001.
25. Ross AB, Bateman TA, Kostenuik PJ, Lacey DL, Dunstan CR, Ferguson VL, Simske SJ. Effect of osteoprotegerin on the mechanical properties of rat bone. *Journal of Materials Science: Materials in Medicine*, 12:583-588; 2001.
26. Bateman TA, Dunstan CR, Ferguson VL, Lacey DL, Ayers RA, Simske SJ. Osteoprotegerin mitigates tail suspension-induced osteopenia. *BONE*, 26:443-449; 2000.
27. Ayers RA, Wolford LM, Bateman TA, Ferguson VL, Simske SJ. Quantification of bone ingrowth into porous block hydroxyapatite in humans. *Journal of Biomedical Materials Research*, 47:54-59; 1999.

28. Bateman TA, Zimmerman RJ, Ayers RA, Ferguson VL, Chapes SK, Simske SJ. Histomorphometric, physical, and mechanical effects of spaceflight and insulin-like growth factor-I on rat long bones. *BONE*, 23:527-535; 1998.

C. Research Support

Ongoing Research Support

Ferguson, V.L. (PI). NSF CAREER Award \$445,024 2/1/2011 – 1/31/2016
National Science Foundation

CAREER: Reverse-Engineering the Bone-Cartilage Interface for Successful Joint Repair - Coupled with a New Program to Promote Diversity in Rehabilitative Bioengineering

This funding supports research on the native interface between bone and cartilage as well as engineered materials that seek to recapitulate natural mechanisms that transmit stresses and strains from stiff bone to neighboring cartilage. The broader impact of this proposed work supports creation and longevity of *YOU'RE@CU*, a program that provides undergraduates with graduate student mentored research projects.

Ferguson, V.L. (PI). Chancellor's Faculty Award \$10,000 6/1/2010 – 5/30/2011
University of Colorado at Boulder

Chancellor's Faculty Award for Excellence in STEM Education for "Assessing *YOU'RE@CU*: A New Program to Promote Diversity in Engineering"

This funding supports the development of an assessment and data collection plan for a new program that pairs graduate student mentors with undergraduate freshmen and research program, *YOU'RE@CU*, that the PI is working to establish along with the CU Building Opportunities through Leadership and Diversity (BOLD) center.

Ferguson, V.L. (PI). Innovative Seed Grant 6/1/2010-5/30/2011
University of Colorado at Boulder \$43,750 1 calendar month

Structure and function relationships at the interface between bone and cartilage

This funding supports investigation of the interface between bone and cartilage using atomic force microscopy and scanning electron microscopy to assess how functional grading of tissue-level mechanical behavior, composition, and microstructural organization facilitate anchoring and load transmission. I supervise sample preparation, microscopy analysis, and data interpretation.

Ferguson, V.L. (PI). Butcher Grant Proposal \$100,000 7/1/2010-6/30/2012
Colorado Initiative for Molecular Biotechnology, University of Colorado at Boulder.

Proteomic indicators for mechanical property changes of the pregnant cervix

This funding is to examine relationships between mechanical property changes in the human cervix and proteomic biomarkers in cervical vaginal fluid as a function of advancing gestational age in pregnancy. I oversee the project, in conjunction with Dr. Antonio Barbera OB/GYN (UCD School of Medicine and Denver Health Medical Center), where I oversee analysis of both mechanical property measurements, biomarker data, and relevant statistical analysis.

Ferguson, V.L. (co-PI) Child and Maternal Health Pilot Project 2/1/2009-1/31/2010
Colorado Clinical and Translational Science Institute \$20,000 0.6 calendar months

Understanding Biomechanical and Molecular Mechanisms in Fetal Membrane Rupture

This funding is to correlate membrane strength and morphology changes with changes in MMP and TIMP levels to investigate molecular mechanisms leading to preterm premature rupture of fetal membranes. I oversee the project on the University of Colorado at Boulder and analyze mechanical testing, histology and scanning electron microscopy data.

Ferguson, V.L. (PI) 12/1/2008-12/31/2011
Amgen, Inc. \$80,000

Examination of myostatin inhibition for treatment of spaceflight-induced muscle loss in mice on Space Shuttle Flight STS-118

This funding is to examine the mechanical properties and quantitative histomorphometry of long bones collected from mice flown on the Space Shuttle STS-118 flight in August 2007. The mice were treated with a

novel inhibitor of myostatin (a protein in the TGF- β superfamily). I oversee the project on the University of Colorado at Boulder and supervise students performing mechanical testing, histology and scanning electron microscopy; data analysis; and preparation of publications.

Completed Research Support

Ferguson, V.L. (PI) 2007 3/1/2007 – 2/28/2008
Univ. of Colorado; Council on Research and Creative Work
Junior Faculty Development Award \$5,000 1 calendar month/year
Fracture Mechanics of Chorioamnion Membranes : Understanding Premature Membrane Rupture during Pregnancy
This funding was to use mechanical testing to study the resistance to fracture and resistance to delamination (of the chorion and amnion layers) of fetal membranes. The main goal of this work was to generate preliminary data for use in subsequent proposals and to establish methods for tissue collection, handling, preparation, and testing within my laboratory. This project set the stage for current ongoing studies in my laboratory of mechanical behavior and composition of fetal membrane tissues and has, thus far, led to one conference abstract and a completed M.S. thesis (M. Schroeder).

Ferguson, V.L. (PI) 2007 7/1/2007 - 6/30/2008
Univ. of Colorado; Council on Research and Creative Work, Seed Grant
\$7,000 1 calendar month/year
Biomechanics, ultrasound and finite element modeling of human umbilical cord tissue
This funding is to use mechanical testing of umbilical cord tissues and ultrasound of umbilical blood flow during pregnancy to provide input into finite element models. The main goal of this work was to generate preliminary data for subsequent studies of the effects of hypertensive disorders of pregnancy on fetal umbilical tissues, where alterations in stiffness of umbilical vessels (and surrounding tissues) would indicate that similar mechanical alterations may occur within the fetal circulation. This project set the stage for current ongoing studies in my laboratory of alterations in fetal artery stiffness and ECM composition with preeclampsia (in human subjects) or intrauterine growth restriction (in ovines). This work has, thus far, led to one conference abstract, one peer-reviewed journal article and one completed M.S. thesis (J. Martin).

Ferguson, V.L. (co-PI) 2006 7/1/2006-12/31/2008
Amgen, Inc.; Grant # OCG4824B \$375,000 2 calendar month/year
Examination of myostatin inhibition for treatment of spaceflight-induced muscle loss in mice on Space Shuttle Flight STS-118
This funding is to examine the functional properties (ex vivo strength and fatigue), histology / immunohistochemistry (i.e., muscle fiber typing), and protein and gene expression from hindlimb skeletal muscles collected from mice flown on the Space Shuttle STS-118 flight in August 2007. The mice were treated with a novel inhibitor of myostatin (a protein in the TGF- β superfamily) – a muscle anabolic therapy. I oversaw aspects of the project ranging from interactions with NASA, health and safety and IACUC protocol development, supervision of lab staff for tissue collection and analysis, and am currently working with our research team on a range of publications stemming from this work.

Ferguson, V.L. (co-PI) 2007 6/1/2006-12/31/2007
Amgen, Inc.; Award#20060101-001 (cost extension) \$397,364 1 calendar month/year
A Randomized, Double-Blind, Placebo Controlled, Ascending Multiple Dose Study to Evaluate the Safety, Tolerability, Pharmacokinetics, and Pharmacodynamics of the AMG745 in Healthy Subjects
This funding is to examine the safety, tolerability, pharmacokinetics, and pharmacodynamics of AMG745, a novel myostatin-related therapy, in healthy adult human subjects during 10 days of complete bed rest. I managed portions of subject recruitment and data collection and analysis, including collection of functional strength data using a Kincom system. This second round of funding supported an additional cohort of human subjects in this study.