

Joseph M. Wallace

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Research Interests

- Understanding organic-inorganic interfaces in biological tissues at the ultrastructural level
- Mechanics of tissues and cells
- Mechanically-mediated skeletal adaptation
- Tissue response to trauma and disease

Education

Ph.D., Biomedical Engineering – The University of Michigan

Ph.D. conferred September 2007; Advisor – Dr. David H Kohn.

Title: Investigating the Inbred Strain-Specific Response to Biglycan Deficiency and Exercise: A Study in Genetically-Mediated Skeletal Adaptation

Masters of Science, Biomedical Engineering - The University of Michigan

M.S.E. conferred May 2004, Ph.D. candidacy attained March 2005

Bachelors of Science, Aerospace Engineering - Georgia Institute of Technology

B.S.E. with Highest Honors conferred May 2002

Research Experience

The University of Michigan, Banaszak Holl Research Group

Department of Chemistry and Michigan Nanotechnology Institute for Medicine and Biological Sciences

Mentor: Professor Mark M. Banaszak Holl (October 2007-present)

Projects Include:

- Utilizing Atomic Force Microscopy to investigate collagen ultrastructure in bone, dentin and tendon
- Utilizing Atomic Force Microscopy to investigate changes in collagen structure and function in mice with Osteogenesis Imperfecta
- Investigating cellular internalization and trafficking of DNA/polymer polyplexes for gene delivery using quantitative confocal microscopy

The University of Michigan, Biomimetics and Biomechanics of Hard Tissues Laboratory

Department of Biomedical Engineering

Mentor: Professor David H. Kohn (May 2002-October 2007)

Projects Included:

- Murine treadmill exercise model testing inbred strain-specific effects of running on long bones of the legs
- Transgenic model testing the inbred strain-specific response to the genetic deletion of the bone matrix protein biglycan
- Investigating the ability of exercise to act a therapeutic agent in diseased bones

Recent Awards and Distinctions

1F32DE018840-01 A1

09/01/2008-09/01-2010

Title: Investigating Ultrastructural Collagen Changes in Osteogenesis Imperfecta

Role: Principal Investigator

The University of Michigan – Rackham Graduate School – February 2008

Nominated for Distinguished Dissertation Award

Ninth International Conference on the Chemistry and Biology of Mineralized Tissues – November 2007

New Investigator Award

The Sixth Annual Meeting of the Midwest Tissue Engineering Consortium – April 2007

Award for best judged poster presentation

The Dominic D. Dziewiatkowski Award - The University of Michigan School of Dentistry – April 2007

Given in recognition of excellence in student research

The University of Michigan Engineering Graduate Student Symposium – November 2006

Best Oral Presentation, Biomechanics Concentration

Regenerative Sciences Training Grant R90-DK071506 - October 2004 to October 2006

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| Professional Memberships | <p>Orthopaedic Research Society (ORS) – Associate Member</p> <p>The American Society for Bone and Mineral Research (ASBMR)</p> |
| Peer Reviewed Publications | <p>Finney WF, Morris MD, Wallace JM, Kohn DH, “Ultrastructural Elastic Deformation of Cortical Bone Tissue Probed by NIR Raman Spectroscopy.” In: <i>Proceedings of SPIE</i> 2004; 5321: 233-241.</p> <p>Morris MD, Finney WF, Callender A, Wallace JM, Kohn DH, “Chemical Structure Changes Accompanying Mechanical Loading of Cortical Bone Tissue.” In: <i>Proceedings of the Eighth International Conference on the Chemistry and Biology of Mineralized Tissues</i>, 2005, WJ Landis and J Sodek, Editors; University of Toronto Press, Toronto, Canada: 227-229.</p> <p>Wallace JM, Rajachar RM, Chen XD, Shi S, Allen MR, Bloomfield SA, Les CM, Robey PG, Young MF, Kohn DH, “The Mechanical Phenotype of Biglycan Deficient Mice is Bone- and Gender-Specific,” <i>Bone</i> 2006; 39 (1): 106-116.</p> <p>Wallace JM, Rajachar RM, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn DH, “Exercise-Induced Changes in the Cortical Bone of Growing Mice are Bone and Gender Specific,” <i>Bone</i> 2007; 40 (4): 1120-1127.</p> <p>Kohn DH, Sahar ND, Wallace JM, Golcuk K, Morris MD, “Exercise Alters Mineral and Matrix Composition in the Absence of Adding New Bone,” <i>Cells, Tissues, Organs</i> 2009; 189: 33-37.</p> <p>Hong SI, Hong SK, Wallace JM, Kohn D, “Ultrastructural Observation and Electron Irradiation Damage of Lamellar Bone,” <i>Journal of Materials Sciences: Materials in Medicine</i> 2009; 20: 959-965.</p> <p>Wallace JM, Golcuk K, Morris MD, Kohn DH, “Inbred Strain-Specific Response to Biglycan Deficiency in the Cortical Bone of C57BL6/129 and C3H/He Mice,” <i>JBMR</i>, In Press, November 2008.</p> <p>Wallace JM, Ron MS, Kohn DH, “Short-term exercise in mice increases tibial post-yield mechanical properties while two weeks of latency following exercise increases tissue-level strength,” <i>Calcif. Tis Int.</i>, In Press, February 2009; DOI 10.1007/s00223-009-9228-8.</p> <p>Hansma P, Yu H, Schultz D, Rodriguez A, Yurtsev E, Peters MC, Miller J, Wallace JM, Kang I, Kohn D, Buckley J, Weaver V, Lotz J, “Tissue Diagnostic Instrument,” Review of Scientific Instruments, March 2009.</p> <p>Wallace JM, Golcuk K, Morris MD, Kohn DH, “Exercise Modulates the Phenotype of Biglycan-Deficient Mice in an Inbred Strain-Specific Manner by Altering Bone Composition and Mechanical Integrity,” <i>Bone</i>, Submitted, December 2008.</p> <p>Kelly CV, Liroff MG, Triplett LD, Leroueil PR, Mullen DG, Wallace JM, Meshinchi S, Baker JR, Orr BG, Banaszak Holl, MM “Stoichiometry and Structure of Poly(amidoamine) Dendrimer-Membrane Complexes,” Submitted Feb 2009, ACS Nano.</p> <p>Wallace JM, Mullen DG, Banaszak Holl MM, “Quantitative Tracking of Polycationic Polymer–Plasmid DNA Polyplexes Indicates a Lack of Correlation Between Cellular Uptake, Lysosomal Colocalization and Gene Expression,” In Preparation.</p> <p>Wallace JM, Banaszak Holl MM, “<i>In Situ</i> Atomic Force Microscopy of Murine Cortical Bone Reveals a Distribution of D-Periodic Spacing and Supports the Twisted Plywood Model of Collagen Fibril Organization,” In Preparation.</p> |
| Presentations & Extended Abstracts | <p>Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn, DH, “Exercise Can Reverse The Phenotype of Biglycan Deficient Mice,” Abstract In: <i>Proceedings of the 2003 ASME International Mechanical Engineering Congress: Advances in Bioengineering</i>, BED Vol. 55, Paper # IMECE-43116, pp. 37-38, Washington D.C.</p> <p>Kohn DH, Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, “Rescuing The Phenotype of Biglycan Deficient Mice Via Exercise,” Abstract in: <i>Proceedings of the 25th Annual Meeting of the American Society of Bone and Mineral Research</i>, 2003, Presentation # 1172, Minneapolis, MN.</p> <p>Wallace JM, Rajachar RM, Chen X, Shi S, Allen MR, Bloomfield SA, Les CM, Robey PG, Young MF, Kohn DH, “The Phenotype of Biglycan-Deficient Mice Can Be Modified By Mechanical Loading,” Abstract in: <i>Proceedings of the 2004 Annual Meeting of the Orthopaedic Research Society</i>, Paper #197, San Francisco, CA.</p> <p>Wallace JM, Ron MS, Kohn DH, “Increased Post-Yield Properties Induced When Exercise is Superimposed on Growth Are Maintained After 2 Weeks With The Addition of Strength.” Abstract In: <i>Proceedings of the 2005 Summer Bioengineering Conference</i>, Abstract # 080261, Vail, CO.</p> <p>Wallace JM, Kohn DH, “The Cortical Bone Phenotype of Biglycan-Deficient Mice is Inbred-Strain-Specific,” Presented at: <i>University of Michigan Engineering Graduate Student Symposium</i>, Nov. 2006, Ann Arbor, MI.</p> |

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| Presentations & Extended Abstracts (cont'd) | <p>Wallace JM, Golcuk K, Morris MD, Kohn DH, "Exercise Compensates for Decreased Tissue Strength in Biglycan Deficient Mice in an Inbred Strain-Specific Manner Through Differential Changes in Mineral Composition and Collagen Cross-Linking," Abstract in: <i>Proceedings of the 2008 Annual Meeting of the Orthopaedic Research Society</i>, Paper #135, San Francisco, CA.</p> <p>Wallace JM, Banaszak Holl M, "Cellular Internalization and Trafficking of Polycationic Organic Polymers-DNA Polyplexes," Presented at: <i>Seventh Annual Meeting of the Midwest Tissue Engineering Consortium</i>, April 2008, Cincinnati, OH.</p> <p>Wallace JM, Banaszak Holl M, "In Situ Atomic Force Microscopy of Murine Cortical Bone Reveals a Distribution of D-Periodic Spacing and Supports the Twisted Plywood Model of Collagen Fibril Organization," Presented at: <i>Eighth Annual Meeting of the Midwest Tissue Engineering Consortium</i>, April 2009, Pittsburgh, PA.</p> |
| Poster Presentations | <p>Wallace JM, Chen X-D, Shi S, Allen MR, Robey PG, Young MF, Kohn DH, "Reversal of Osteoporotic-like Phenotype In Biglycan Knockout Mice," Presented at: <i>University of Michigan Dental School Research Symposium</i>, February 2003, Ann Arbor, MI.</p> <p>Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn DH, "Gender Specific Response to Exercise in C57BL6/129 Mice," Abstract In: <i>Proceedings of the 2003 American Society of Biomechanics Annual Conference</i>, Toledo, OH.</p> <p>Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn DH, "Exercise Can Reverse The Phenotype of Biglycan Deficient Mice," Abstract In: <i>Proceedings of the 2003 American Society of Biomechanics Annual Conference</i>, Toledo, OH.</p> <p>Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn DH, "Exercise Can Reverse The Phenotype of Biglycan Deficient Mice," Presented at: <i>2nd Annual Symposium of The University of Michigan Bone Center</i>, October 2003, Ann Arbor, MI.</p> <p>Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn DH, "The Phenotype of Biglycan-Deficient Mice Can Be Modified By Mechanical Loading," Presented at: <i>University of Michigan Dental School Research Symposium</i>, February 2004, Ann Arbor, MI.</p> <p>Finney WF, Morris MD, Wallace JM, Kohn DH, "Bone Mineral Ultrastructural Response to Elastic Deformation Probed By Raman Spectroscopy," Abstract In: <i>Proceedings of the 2004 Annual Meeting of the Orthopaedic Research Society</i>, Poster # 0500, San Francisco, CA (Presented by William F. Finney).</p> <p>Wallace JM, Rajachar RM, Chen X-D, Shi S, Allen MR, Bloomfield SA, Robey PG, Young MF, Kohn DH, "Exercise Can Reverse The Phenotype of Biglycan Deficient Mice," Presented at: <i>40th Anniversary of Biomedical Engineering Symposium</i>, April 2004, Ann Arbor, MI.</p> <p>Wallace JM, Kohn DH, "The Cortical Bone Phenotype of Biglycan-Deficient Mice is Inbred-Strain-Specific," Abstract In: <i>Proceedings of the 2007 Annual Meeting of the Orthopaedic Research Society</i>, Poster # 1349, San Diego, CA.</p> <p>Wallace JM, Golcuk K, Morris MD, Kohn DH, "The Cortical Bone Phenotype of Biglycan-Deficient Mice is Inbred-Strain-Specific," Presented at: <i>The Sixth Annual Meeting of the Midwest Tissue Engineering Consortium</i>, April 2007, Ann Arbor, MI.</p> <p>Wallace JM, Golcuk K, Morris MD, Kohn DH, "Biglycan Deficiency Impacts The Extracellular Matrix of Bone in an Inbred Strain-Specific Manner," Presented at: <i>The Ninth International Conference on the Chemistry and Biology of Mineralized Tissues</i>, November 2007, Austin, TX.</p> <p>Miller JC, Peters MC, Kanjirath PP, Barros JA, Wallace JM, Hansma P, "Novel Handheld Device to Determine Physical Properties of Hydrated Dentin," Presented at: <i>University of Michigan Dental School Research Symposium</i>, February 2008, Ann Arbor, MI.</p> |
| Relevant Coursework | <p>Biology and Bioengineering: Molecular Biology, Biological Chemistry, Quantitative Cell Biology, Organogenesis of Mesenchymal Stem Cells and Skeletal Tissues, Quantitative Physiology and Pathophysiology, Cardiovascular Biomechanics, Tissue Mechanics, Tissue Engineering</p> <p>Solid and Fluid Mechanics: Statics, Dynamics, Deformable Bodies, Structural Analysis, Elasticity and Viscoelasticity, Continuum Mechanics, Low and High Speed Aerodynamics, Thermodynamics and Compressible Flow, Jet and Rocket Propulsion, Experimental Fluid Dynamics</p> |
| Teaching Experience and Interests | <ul style="list-style-type: none"> • Class entitled "Teaching Engineering" focused on teaching to varied learning styles, developing courses. • Graduate mentor: undergraduate student (May 2004-May 2005), terminal Masters student (May 2005-May 2006), dental research student (May 2005-August 2006). • General teaching interests: Skeletal Biology and Mechanics, Introduction to Mechanics, Sections in Quantitative Physiology or Pathophysiology |