

PROMOTION AND TENURE
(Assistant Professor to Associate Professor)
Area of Excellence — Research/Creative Activity
School of Health and Rehabilitation Sciences
2009-10

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AREA OF EXCELLENCE

My chosen area of excellence is **research** to which I devote 70% of my time. This is evident by the weight of my CV to this area; however, I believe I have achieved research excellence without compromising endeavors in teaching and service. My trifold work is consistent with the missions of my department, school and campus of being recognized through research and creative activity, teaching and learning, and civic engagement (service).

RESEARCH STATEMENT

My research focuses on normal and abnormal functioning, and treatment of the musculoskeletal system. This direction is consistent with 2002–11 being the ‘Bone and Joint Decade’—a global initiative targeting musculoskeletal conditions. The translational approach of my research matches the NIH Roadmap for Medical Research and fits with the newly formed Indiana Clinical and Translational Sciences Institute. I use animal and clinical models to study clinically translatable questions in 4 main areas: 1) skeletal effects of selective serotonin reuptake inhibitors; 2) lifelong skeletal benefits of exercise during growth; 3) low-intensity pulsed ultrasound therapy for musculoskeletal conditions, and; 4) musculoskeletal conditions in sports medicine.

Skeletal effects of selective serotonin reuptake inhibitors

I began investigating selective serotonin reuptake inhibitors (SSRIs) during my post-doctoral training with Dr. Charles H. Turner (Indiana University). Based on evidence that bone cells possess functional pathways for responding to and regulating the uptake of serotonin, I explored whether mice genetically deficient in the serotonin transporter (SERT) possessed a skeletal phenotype. Analyses showed these animals consistently had reduced bone mass, size and strength. This is clinically relevant as the SERT is the target of SSRIs, popular agents for treating affective conditions. To improve the translatability of my findings, I next treated mice with a popular SSRI (Prozac[®]) to show pharmacological inhibition of the SERT had similar negative skeletal effects.

The importance of this work is reflected in its recognition. I presented the data as a plenary oral presentation at the American Society of Bone and Mineral Research (ASBMR) 25th Annual Meeting. This meeting attracted >5,000 registrants, and only 30 (<2%) of the 1,800 abstracts were selected as plenary oral presentations. I published the data as first and corresponding author in *Endocrinology*, where it remained in the top 10 most read articles for 2 yrs following publication despite over 1000 articles being published in the interim. The article was cited 24 times in 2008 alone, including in *Cell* and *Nature Reviews Neuroscience*. It was cited 4 times in 2007 in *Archives of Internal Medicine*. The respective clinical studies in these later citations showed individuals taking SSRIs had greater bone loss and increased fracture risk than individuals not taking these agents. These clinical observations support my preclinical data and confirm the translatability of my line of inquiry.

My work into the skeletal effects of SSRIs has contributed to the missions of my department, school and campus of being recognized through research and creative activity. In particular, it has been subject to media attention wherein my department, school and campus affiliations were widely disseminated. This included being the lead health story on the national CBS News homepage, and being featured on over 500 other global web pages and 30 radio and television programs across the nation. It also included a featured interview on *WFYI 90.1 FM* for their ‘Sound Medicine’ program.

My contribution to understanding the skeletal effects of SSRIs continues. Following publication of my initial data, I wrote an invited review for *Molecular and Cellular Endocrinology*. The resulting ‘At the Cutting Edge’ article was lead in its issue and featured on the cover. More significantly, my data contributed to the successful submission of an NIH R01 grant application for my collaborator Dr. Michael M. Bliziotes (Oregon Health and Science University). I was not established at the time to be principal investigator (PI), but was included as co-investigator on the subcontract awarded to Dr. Turner. This funding has enabled me to perform further studies to show that an SSRI causes: 1) greater reductions in bone accrual than a tricyclic anti-depressant; 2) reduced bone accrual independent of effects on animal physical activity levels, and; 3) accelerated bone loss following experimentally-induced menopause. The latter work was recently published as first and corresponding author in *Menopause*, and the resultant publication has been cited in the very high-impact journals *New England Journal of Medicine* and *Nature Medicine*. Most recently, my collaborators and I contributed two review articles on this topic to *Bone*. These articles are currently ‘in press’.

Plan for ongoing and future endeavors

My interest into the skeletal effects of SSRIs continues. Recent contributions by Dr. Gerard Karsenty's team (Columbia University) identified gut-derived serotonin as having direct skeletal effects via the activation of specific receptors located on osteoblasts. This provided a major advance to the field, but did not answer the question as to how SSRIs influence the skeleton. Chronic administration of SSRIs reduces circulating serotonin levels which (according to Dr. Karsenty's data) would increase bone formation resulting in a high bone mass phenotype. Our data indicates this is not the case. One scenario is that SSRIs impact the skeleton by directly inhibiting the SERT located on bone cell membranes. This may increase local serotonin levels, in spite of decreased circulating serotonin, by reducing its removal from the cell microenvironment. I have submitted a new 5-year NIH R01 application (\$1.9 million) as PI for the Oct/Nov 2009 review cycle to explore this and related questions.

Lifelong skeletal benefits of exercise during growth

Reduced bone strength is predominantly an age-related phenomenon, whereas the ability of the skeleton to respond to mechanical loading decreases with age. This raises the question of whether exercise-induced bone changes during growth persist into adulthood. I began investigating this question towards the end of my post-doctoral training when I approached Dr. Turner with an idea for an animal study. The study involved mechanical loading (or 'exercising') one forelimb of young (5 wk old) rats using the ulna axial compression loading model developed by Dr. Lance Lanyon's group (Royal Veterinary College, UK). Animals were exercised for 7 wk to induce unilateral bone adaptation, while the contralateral forelimb served as an internal control. Animals were subsequently restricted to home-cage activities until 2 yrs of age during which time periodic measures of bone health were taken. Using this approach, I demonstrated that exercise during a period of rapid skeletal growth resulted in a lifetime of benefit to bone structure and strength.

My data in this area is having a significant impact. I presented it at conferences and was awarded AIMM-ASBMR John Haddard Young Investigator and ASBMR-Harold Frost Young Investigator Awards. I published the data in the top-ranked *Journal of Bone and Mineral Research* where it was cited 14 times in the year following publication. The data also contributed to the research missions of my department, school and campus as it received national and international media attention. This included a one-page article in *Diario Médico* (largest medical publication in Spain) and an article in *First for Women* which has a national readership of 2 million people. This latter lay-person coverage supports my goal of performing translatable research.

Plan for ongoing and future endeavors

I am pursuing further research in this area and have commenced studies translating my data to a clinical population. Exercise during growth positively alters bone structure by preferentially causing periosteal bone formation. As bone loss during aging occurs primarily on the endocortical surface and not periosteal surface, the enhanced structure generated by exercise during adolescence may remain intact until senescence where it may have anti-fracture properties. Unfortunately, it is not practically possible to establish this using a prospective clinical study. Instead, I am using throwing athletes as a model. Throwers are useful as: 1) the unilateral upper extremity loading associated with throwing enables the contralateral side to be used as an internal control; 2) I have shown in a preliminary study that throwers have very large side-to-side differences in midshaft humeral bone size and strength, and; 3) throwers retire completely from participation if not selected to play at higher levels of competition. The latter enables study of the sustainability of exercise effects after loading cessation.

To further my clinical studies into the lifelong skeletal effect of exercise during growth I submitted a new 5-year NIH R01 application (\$1.2 million) as PI that was reviewed during the Jun/Jul 2009 review cycle. The application was well received and it looks likely that it may be awarded following resubmission which will take place in Nov 2009. In addition, I have developed a research laboratory within my school equipped with dual-energy x-ray absorptiometry (DXA) and peripheral quantitative computed tomography (pQCT). This laboratory has become an important resource for investigators on campus as well as those at other institutions. For instance, I am currently collaborating on projects with investigators from the IU School of Medicine, IU School of Physical Education and Tourism Management, Riley Hospital for Children, Purdue University, Indiana Hand Center, and Eli Lilly & Company.

Low-intensity pulsed ultrasound therapy for musculoskeletal conditions

Research over the previous two decades has shown low-intensity (≤ 100 mW/cm²) pulsed ultrasound (LIPUS) can accelerate fracture repair and stimulate healing of non-united fractures. These findings are interesting as physical therapists have traditionally been instructed to avoid applying ultrasound to bone because of a fear of tissue damage. To address this issue, and the fact that LIPUS units developed for treating bone injuries are not available for use by physical therapists, I questioned whether conventional ultrasound therapy units as used by physical therapists may accelerate bone healing. These units at their lowest intensity output (100 mW/cm²) were found to accelerate bone healing following osteotomy and stress fracture, but were potentially detrimental to the endochondral ossification occurring following a traumatic fracture. These data were published as either first or senior (last) author in the journals *Physical Therapy*, *Journal of Orthopaedic Research* and *Bone*.

In addition to investigating LIPUS for bone injuries, I have been studying its efficacy in acute ligament and chronic tendon injuries. LIPUS accelerated but did not improve ligament healing in an animal model and had no effect on patellar tendinopathy symptoms in a randomized controlled trial. The ligament data were published as first author in the *American Journal of Sports Medicine* with 5 students as co-authors, and awarded international (ASICS Award for Best Young Investigator, Australian Sports Medicine Federation) and national (New Investigator Award, American College of Sports Medicine [ACSM]) research awards. The tendon data was published as first author in *Rheumatology* (with international collaborators) where it was featured in an accompanying editorial. Both sets of data contributed to the research missions of my department, school and campus as they received national and international media attention, including an article by *Reuters Health* and mention on Paul Harvey's *News and Comment* radio show that was syndicated on 1200 radio stations. In addition to these recognitions, I was 1-of-2 therapists invited to participate in *Ultrasound and Evidence-Based Practice: Are They Compatible?* This was the first 'Podcast Debate' for the *Physical Therapy* journal.

Plan for ongoing and future endeavors

I have ongoing studies investigating LIPUS. In association with campus (Dr. David Burr) and national (Dr. Ronald Midura, Cleveland Clinic) collaborators, we are investigating LIPUS as a potential countermeasure for the impaired healing that occurs when a fracture occurs in a hypogravity environment (i.e. on the lunar surface). For this work, I am the PI on a subcontract awarded by the National Science and Biomedical Research Institute.

Musculoskeletal conditions in sports medicine

As a physical therapist that previously treated elite athletes, I also have research interests more related to my heritage. This includes studies into the pathophysiology and management of stress fractures, tendon overuse injuries, acute ligament injuries and chronic knee pain. My contribution to understanding stress fractures has received considerable recognition resulting in invitations to present at the State of the Science Stress Fracture Research Conference hosted by the Army, Combined Sections Meeting of the American Physical Therapy Association, and ACSM and ASBMR Annual Meetings. My presentation at the later resulted in invitations to contribute an article to *Current Osteoporosis Reports* and present at the 7th Annual Bone Day conference hosted by Dr. Nelson B. Watts (University of Cincinnati, OH).

Mention should also be given to the systematic review and meta-analysis of the efficacy of patellar taping and bracing for the treatment of chronic knee pain I recently completed with international collaborators. We found tape applied to exert a medially-directed force on the patella produces a clinically meaningful change in chronic knee pain. This study was published in the second highest ranking Rheumatology journal (*Arthritis & Rheumatism: Arthritis Care and Research*) and was featured in a subsequent editorial published in *Nature Clinical Practice Rheumatology*. Most satisfying was the coverage of this work in the mainstream international magazine *Men's Health* which further indicates my ability to perform translatable research.

Plan for ongoing and future endeavors

I am continuing my research into musculoskeletal conditions in sports medicine. In particular, my international collaborators and I are currently performing systematic reviews on topics related to stress fractures and tendon overuse conditions.

TEACHING STATEMENT

My primary teaching responsibility is as lead instructor for *Musculoskeletal Practice Patterns I (P541)* and *II (P622)*. These 4-credit-hour graduate courses involve 6-contact-hours per week (2 lecture & 4 laboratory hours) with a class of 32-36 Doctor of Physical Therapy (DPT) students. I present 90% of lectures and 50% of laboratory material, write, administer and grade all written exam material, and perform 50% of laboratory exams. The remaining class portions are given by a colleague; however, I am present during all class hours.

My teaching philosophy is to encourage future clinicians to be life-long critical thinkers who use the available evidence to guide their clinical decision making. This is consistent with 'Vision 2020' of the American Physical Therapy Association and the general direction of healthcare, and contrasts with the rote, recipe-like learning involved in traditional physical therapy training. My teaching philosophy stems from clinical experience working with internationally recognized therapists who demonstrated to me that clinical success is determined not by an ability to memorize material, but by how well one understands basic concepts and can problem-solve to apply these concepts to individual patients. This is important to instill in students as they matriculate in my courses as musculoskeletal practice patterns represent one of the four major practice patterns in physical therapy, and students proceed to clinical rotations and ultimately practice following completion of my courses.

I inherited the musculoskeletal practice pattern courses from predecessors; however, both courses had been taught only one semester within the curriculum prior to my arrival. Consequently, both required considerable restructuring. Since inheriting the courses I have modified both based on my personal teaching philosophy, feedback from students and clinicians, internal and external peer-review, and continual self-assessment. New course syllabi were constructed to elevate them to the higher levels of synthesis and evaluation on Bloom's taxonomy. To bring the class content in line with the syllabi, classes were reconstructed, new assessment methods developed, and evidence-based readings distributed. Classes now incorporate a multimodal approach to teaching to facilitate the learning of concepts and their application, as opposed to the learning of raw material with limited application. This has involved the use of PowerPoint presentations, interactive internet resources, and applied laboratory-based activities. Clinical competency checks and multiple-choice class tests were introduced throughout each class to encourage progressive learning of laboratory and theory material, respectively, and aid in proactively identifying struggling students.

My teaching approach is effective, based on student feedback, peer-review and other performance indicators (i.e. 100% pass rate of our students on their licensure exam). Quantitative anonymous student evaluations consistently rank my courses and instruction above departmental averages, and qualitative statements from students and peers confirm that I am instructing at the level of my pedagogic goal. Most rewardingly, one student recently commented at a national conference that he "wasted" his time attending a 3 hour session on cutting-edge management of tendon injuries as he had already learnt everything that was covered in my class.

Other teaching endeavors I have completed include developing a student mentoring program and mentoring research students. I initiated and developed a novel mentoring program wherein high-achieving senior physical therapy students mentor junior students in anatomy, physiology and neuroscience. I initiated this program to: 1) assist junior students in the foundational sciences; 2) provide senior students an opportunity to develop teaching skills, and; 3) develop collegial connections across physical therapy classes. This program is now in its fourth year. I have also mentored a sizeable number of students in research, including 4 research and 19 professional graduate students. These numbers are relatively large considering my school has only in the past year started a research degree program. I particularly enjoy encouraging professional graduate students to participate in research as these students are not typically exposed to laboratory-based research in their degree program, and I have found they enjoy the challenge and learn valuable skills translatable to their future clinical careers.

Plan for advancing teaching endeavors

I plan to continue updating and improving my teaching based on self-evaluation, and feedback from students and peers. This will include the addition of new class features, such as opportunities to assess pathological individuals in class. Also, with the recent addition of a research degree program within my school I see great opportunities in terms of taking a leading role in the teaching of research knowledge and skills.

SERVICE STATEMENT

I devote approximately 10% of my time to service endeavors. I have actively sought service opportunities as a means of furthering the missions of my department, school and campus, and to advance my professional development. I accept service opportunities when I believe I can: 1) provide specific expertise; 2) have a significant impact; 3) develop in my chosen area of excellence [research], and; 4) serve the better good of my department, school and campus, and the wider community.

To aid my development in research, I have been accepting of invitations to review the work of others. I rarely refuse requests to peer-review scientific manuscripts submitted for publication as I appreciate the effort of others in reviewing my work and I see reviewing as a way of guiding science and staying 'at the cutting edge'. I have peer-reviewed 133 individual manuscripts (>26 manuscripts/yr) submitted to 41 different journals while in rank. I complete my reviews in a timely manner (>95% of my reviews were submitted earlier than requested by editors), and make sure that they are constructive. I believe these features contributed to my invitation to serve on 3 journal editorial boards.

I also see great value in reviewing grants applications. This keeps me current with work being done in my field, and helps me learn how funding decisions are made and what constitutes a good application. I have reviewed 57 grant applications while in rank (>11 applications/yr). This has included applications submitted to: 1) the campus, enabling me to contribute to its research mission; 2) state- and national-level funding agencies, enabling me to guide both local and national research endeavors, and; 3) international funding agencies, enabling me to keep track of and guide research on a more global scale.

In addition to service in peer-review, I have contributed professionally by moderating sessions at scientific meetings and completing media interviews. I enjoy these activities as they provide opportunities to convey the importance of research in both scientific and lay-person terms. This enables me to reflect on my own work to ensure it continues to be scientifically sound, yet also relevant to the broader community. Via my media work, I have been able to raise the local, national and international profiles of my department, school and campus.

I enjoy service activities at the department, school and campus levels. I serve in both expected and unexpected capacities within my department. Expected roles include formally advising students, contributing to the DPT accreditation process, contributing to curriculum development, and providing input on student matriculation. I have provided unexpected service by serving as the Director of Research, initiating a student mentoring program, and conceptualizing a biannual newsletter. The Director of Research role is an unpaid service I see as important if our department and school are to remain relevant to the campus and greater community. In this role, I guide faculty in their research endeavors, disseminate information on funding opportunities, and provide assistance with funding proposal development.

I appreciate the tenuous status of my school because of its small size and relative youth. I am primarily addressing these issues by increasing its research productivity, but also through school-level service. This has included: 1) chairing the Academic Studies and Research Development Committee wherein I wrote the school honor code; 2) being a member of 7 search-and-screen committees including those for the dean of the school, associate dean for research, and chair of physical therapy, and 3) being a member of the PhD Task Force which developed the school's PhD program. On the University-level I have served twice as a grant reviewer for the Vice Chancellor for Research, and currently serve as a member of the University Faculty Council.

Plan for advancing service endeavors

I plan to continue service in order to grow both personally and professionally, and develop the reputations of my department, school and campus. I plan to more proactively guide science and its dissemination by taking greater leadership roles within professional organizations, and on journal editorial and funding agency boards. I have started this with my recent appointments as an Associate Editor for the *British Journal of Sports Medicine* and as an ad hoc member of funding review panels for the NIH and NSF. To facilitate the reputations of my department and school, I plan to expand my Director of Research role. This will include developing a strategic plan, which will include gaining 'core center' status on the IUPUI campus for our facilities. At the university-level, I plan to continue contributing where my expertise and input is indicated.

FIVE MOST SIGNIFICANT PUBLICATIONS (see Appendices 14-18)

The following five publications were chosen as representative publications in the 4 main areas of my research: 1) skeletal effects of selective serotonin reuptake inhibitors; 2) lifelong skeletal benefits of exercise during growth; 3) low-intensity pulsed ultrasound therapy for musculoskeletal conditions, and; 4) musculoskeletal conditions in sports medicine. Justification for their selection and evidence for their significance is provided.

1. **Warden SJ**, Robling AG, Sanders MS, Bliziotes MM and Turner CH. Inhibition of the serotonin (5-hydroxytryptamine) transporter reduces bone accrual during growth. *Endocrinology* 2005;146:685-693

- See **Appendix 14** for reprint of this paper.
- This was the first study to demonstrate potentially negative effects of commonly prescribed antidepressants (selective serotonin reuptake inhibitors [SSRIs]) on the skeleton, with selective serotonin reuptake inhibitors [SSRIs] reducing bone mass, size and strength in growing mice
- Clinical studies have subsequently confirmed the findings by showing SSRIs increase bone loss and fracture risk in humans, indicating the translatability of my data to the clinical setting
- Data was presented as a plenary oral presentation at the American Society of Bone Mineral Research 25th Annual Meeting, an international meeting attended by >5,000 registrants and where only 30 (<2%) out of 1,800 submitted abstracts were selected for plenary oral presentation
- Abstracts of the data were awarded a Young Investigator Award at the American Society of Bone Mineral Research 25th Annual Meeting and a New Investigator Recognition Award at the 50th Annual Meeting of the Orthopaedic Research Society
- Findings were subject of wide local, national and international media attention, including being the leading health story on the national CBS News homepage (**Appendix 19**), and being featured on over 500 other global web pages and 30 radio and television programs across the nation
- Paper was published as first and corresponding author in the leading peer-reviewed journal *Endocrinology* which is widely-respected as a journal that has defined the science of endocrinology for most of the twentieth century
- Paper remained in the top 10 most-frequently read articles in *Endocrinology* for two years following its publication despite over 1000 articles being published in the journal in the interim (**Appendix 20**).
- Paper was co-authored by institutional (A.G.R. and C.H.T.) and nationally (M.M.B.) based collaborators
- Paper was co-authored by a Doctor of Medicine student (M.S.S.) who participated as part of the Student Research Program in Academic Medicine
- Paper resulted in subsequent invitations to contribute review articles to the journals *Molecular and Cellular Endocrinology*, *Bone* and *Journal of Musculoskeletal and Neuronal Interactions*
- Paper has been cited 61 times since publication (>15X/yr, according to Google Scholar [**Appendix 21**]), including being cited in the very high impact journals *Cell* (impact factor = 31.3) and *Nature Reviews Neuroscience* (impact factor = 25.9) (these impact factors rank these journals in top 20 [<1%] out of all journals) (**Appendix 22**).
- Paper was cited 4 times in 2007 in *Archives of Internal Medicine* (Ranked 8th out of 107 general and internal medicine journals [impact factor = 9.9]) with the respective clinical studies supporting my preclinical data and confirming the translatability of my line of inquiry (**Appendix 22**).
- Findings formed the basis of a successful R01 grant application to the National Institutes of Health as co-investigator
- Findings formed the basis of a pending R01 grant application to the National Institutes of Health as principal investigator

2. **Warden SJ**, Fuchs RK, Castillo AB, Nelson IR and Turner CH: Exercise when young provides lifelong benefits to bone structure and strength. *Journal of Bone and Mineral Research* 2007;22:251-259

- See **Appendix 15** for reprint of this paper.
- This three year study was the first to show that exercise when young has lifelong benefits on bone structure and strength, and potentially, fracture risk
- This novel finding cannot feasibly be assessed in human trials, and suggests that the old exercise adage of "use it or lose it" may not be entirely applicable to the skeleton and that individuals undergoing skeletal growth should be encouraged to perform impact exercise to maximize their lifelong skeletal health
- Study awarded a AIMM-ASBMR John Haddad Young Investigator Award at the AIMM-ASBMR John Haddad Young Investigator's Meeting (**Appendix 23**) and a ASBMR-Harold Frost Young Investigator Award at the 35th International Sun Valley Workshop on Skeletal Tissue Biology (**Appendix 24**)
- Findings were subject of wide national and international media attention, including a one-page article in *Diario Médico* (largest medical publication in Spain) (**Appendix 25**), and articles in *First for Women* (has a national readership of 2 million people) (**Appendix 26**), *L.A. Health News* (**Appendix 27**) and the Indianapolis Star newspaper (**Appendix 28**)
- Paper published as first and corresponding author in the leading bone journal *Journal of Bone and Mineral Research* (impact factor = 6.4 [ranked in top 4% of all journals])
- Paper cited 14 times in the year following publication (according to Scopus) (**Appendix 29**)
- Paper co-authored by departmental (R.K.F.) and institutional (A.B.C. and C.H.T.) collaborators
- Paper co-authored by a Doctor of Medicine student (I.R.N.) who participated as part of the Student Research Program in Academic Medicine
- Findings formed the basis of pending R01 and R15 grant applications to the National Institutes of Health

3. **Warden SJ**, Avin KG, Beck EM, DeWolf ME, Hagemeyer MA and Martin KM. Low-intensity pulsed ultrasound accelerates and a non-steroidal anti-inflammatory drug delays knee ligament healing. *American Journal of Sports Medicine* 2006;34:1094-1102

- See **Appendix 16** for reprint of this paper.
- This study found that low-intensity pulsed ultrasound after ligament injury may facilitate earlier return to activity, whereas non-steroidal anti-inflammatory drugs may elevate early reinjury risk
- Study awarded an international research award (ASICS Award for Best Young Investigator at the 2005 Australian Sports Medicine Federation Fellows Awards) (**Appendix 13**) and a prestigious national research award (ACSM 2006 New Investigator Award [Clinical Science] at the 53rd American College of Sports Medicine Annual Meeting) (**Appendix 30**)
- Paper published as first and corresponding author in highly-ranked journal *American Journal of Sports Medicine* (2nd ranked journal in both the 'Sport Sciences' [**Appendix 31**] and 'Orthopedics' [**Appendix 32**] disciplines)
- Paper was the third most-frequently read article in *American Journal of Sports Medicine* in July 2006 (**Appendix 33**) and featured on the cover of its respective journal issue
- Findings were subject of national media attention, including an article by *Reuters Health* (**Appendix 34**) and mention on Paul Harvey's *News and Comment* radio show that was syndicated on 1200 radio stations
- Paper co-authored by five Doctor of Physical Therapy students (K.G.A., E.M.B., M.E.D., M.A.H. and K.M.M.)
- Study was funded by the IUPUI Office of Professional Development

4. **Warden SJ**, Metcalf BR, Kiss ZS, Cook JL, Purdam CR, Bennell KL and Crossley KM: Low-intensity pulsed ultrasound for chronic patellar tendinopathy: a randomized, double-blind, placebo-controlled trial. *Rheumatology* 2008;47:467-471
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- See **Appendix 17** for reprint of this paper.
 - This randomized, double-blind, placebo-controlled study provided high-level evidence (Level 1b according to Sackett DL, et al. *Evidence-Based Medicine: How to Practice and Teach EBM*, 2nd ed. Edinburgh, Scotland: Churchill Livingstone Inc; 2000:173-177) that ultrasound therapy is not efficacious in the management of degeneration of the patellar tendon
 - Data were published as first and corresponding author in the highly-ranked journal *Rheumatology* (ranked in the top 10% of all journals [impact factor = 4.1]) (**Appendix 35**)
 - Manuscript was selected to be accompanied by an editorial in its respective journal issue which stated that the study was "...an extremely well-executed randomized controlled trial..." (**Appendix 36**)
 - Findings were featured in the 'SportsMedUpdate' section of the *British Journal of Sports Medicine* (**Appendix 37**)
 - Study methodology received a near perfect (9-out-of-10) score on the Physiotherapy Evidence Database (PEDro) scale (PEDro scale interpretation: 0-3 = poor; 4-5 = fair; 6-10 = high) (**Appendix 38**)
 - Paper co-authored by internationally-based collaborators (B.R.M., Z.S.K., J.L.C., C.R.P., K.L.B. and K.M.C.)
5. **Warden SJ**, Hinman RS, Watson MA Jr, Avin KG, Bialocerkowski AE and Crossley KM: Patellar taping and bracing for the treatment of chronic knee pain: a systematic review and meta-analysis. *Arthritis and Rheumatism: Arthritis Care and Research* 2008;59:78-83
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- See **Appendix 18** for reprint of this paper.
- This systematic review and meta-analysis provided the highest-level evidence (Level 1a according to Sackett DL, et al. *Evidence-Based Medicine: How to Practice and Teach EBM*, 2nd ed. Edinburgh, Scotland: Churchill Livingstone Inc; 2000:173-177) that taping to exert a medially directed force on the patella produces a clinically meaningful change in chronic knee pain
- Paper was published as first and corresponding author in highly-ranked journal *Arthritis and Rheumatism: Arthritis Care and Research* (2nd ranked journal in the 'Rheumatology' discipline [impact factor = 6.8]) (**Appendix 35**)
- Findings were the focus of an editorial published the 'Research Highlights' section of *Nature Clinical Practice Rheumatology* (3rd ranked journal in the 'Rheumatology' discipline [impact factor = 5.7]) (**Appendix 39**)
- Structured abstract was written about the study by the Centre for Reviews and Dissemination and included in the Database of Abstracts of Reviews and Effects (DARE) (**Appendix 40**)
- Findings were subject of national media attention, including an article by *Reuters Health* (**Appendix 41**) Study was the focus of an article in the mainstream international magazine *Men's Health* (**Appendix 42**)
- Paper co-authored by internationally-based collaborators (R.S.H., A.E.B. and K.M.C.)
- Paper co-authored by two Doctor of Physical Therapy students (M.A.W. and K.G.A.)

RESEARCH FUNDING

I have consistently sought funding during my time in rank, despite the current economic environment which has made funding increasingly difficult to obtain. I have been successful in obtaining 7 awards as principal investigator totaling \$582,545, which has included \$153,857 in indirect cost recovery. One award was obtained from a national agency (National Space Biomedical Research Institute), one from a national foundation (Massage Therapy Foundation), three from a local industry source (Eli Lilly and Company), and two from institutional offices (IUPUI Office of the Vice Chancellor for Research and Graduate Education, and IUPUI Office for Professional Development). In addition, I have obtained funding as co-investigator from two national

agencies (National Institutes of Health [NIH] R01 – \$608,000; U.S. Army Medical Research and Materiel Command– \$200,209) and one international agency (Australian Sports Commission – \$40,000), as a co-mentor on a NIH K23 award (\$598,008), and as a consultant on NIH K01 (\$600,857) and R03 awards (\$147,586). Thus, I have been associated with the award of \$2.8 million in research funding while in rank.

I currently have \$6.7 million in research funding under consideration, including \$3.4 million submitted as principal investigator which are associated with \$1.2 million in indirect cost recovery. This includes two NIH R01 applications, one of which recently received very positive reviews from its study section review panel and stands a very good chance of being funded upon resubmission in Nov 2009. In addition, I submitted 12 other funding applications as principal investigator while in rank that were not considered fundable, including an NIH R01 application and three NIH R21 applications.

SCHOLARLY PUBLICATIONS AND PRESENTATIONS

I have been a prolific scholarly writer during my time in rank with a total of 97 research or creative activity publications published, accepted for publication, or submitted for publication. This includes 55 full-length research-related publications and 42 abstracts, with the breakdown of the full-length research-related publications authored or co-authored since appointment shown in Table 2. Over half (30-out-of-55) of these later publications are peer-reviewed research articles, on which I am primary/first author on 50% (15-out-of-30) and corresponding/senior author on 60% (18-out-of-30). The large number of peer-reviewed research articles reflects the amount of original research I have performed or contributed to while in rank. I am primary author on over three quarters (19-out-of-25) of all other full-length research-related publications, which means that I am primary author on >60% (34-out-of-55) of all full-length publications since appointment. Sixteen of the publications were invited (reviews, editorials and book chapters) providing evidence of external recognition of my work and contributions.

In addition to full-length research-related publications, I have authored or co-authored 42 research-related published abstracts. The approximate 1:1 (55:42) ratio of full-length research-related publications to published abstracts indicates my ability to take data presented in abstract form to full-length publication—the penultimate level of dissemination. I am primary/first or senior/last author on over three quarters (32-out-of-42) of published abstracts. Many of these abstracts were coupled with research-related presentations. Since appointment I have personally given 41 research presentations. These have included 3 international invited, 14 national invited, 7 local invited, 2 international peer-reviewed and 9 national peer-reviewed oral presentations.

Table 2. Research-related full-length publications since appointment.

Publication type	Current status			Total
	Published	In press	Submitted	
Peer-reviewed research	25	1	4	30
Peer-reviewed review	4	2	—	6
Invited review	8	1	—	9
Invited editorial	2	2	—	4
Case report	—	—	1	1
Letter	2	—	—	2
Book chapter	2	1	—	3
Total	43	7	5	55

STATURE OF JOURNALS IN WHICH PUBLICATIONS APPEAR

Table 3 outlines the stature of a sample of the journals in which my work has appeared since appointment. Data was acquired from the Science Edition of the 2008 ISI Journal Citation Reports (Thomson Scientific, Stamford, CT). This product provides quantifiable statistical data that enables a systematic, objective way to evaluate the stature of individual journals. I have used the two most commonly reported features of this product to document the standing of the journals in which I have recently published. These are:

1. Journal impact factor A measure of how many times the ‘average article’ published in the past two years in a journal were cited in 2008. Enables the journal’s relative importance (rank) to be compared with all journals, as well as with those within the journal’s particular field.
2. Citation counts Provides an indication of how frequently current researchers are using a particular journal. Enables the journal’s use as a dissemination medium to be compared with all journals, as well as with those within the journal’s particular field.

Based on the journal impact factors and citation counts, my work is of quantifiably high stature. It has frequently been published in the top-ranked and most-cited journals, when compared to both discipline specific and all journals. For instance, 14 of my full-length publications were published in journals ranked in the top 10% of all journals according to impact factor, while I published in 4 out of the top 5 ranked journals in the sports sciences discipline (incl. the top 2 ranked journals). Similarly, many of the journals in which my work appears are in the most cited journals in their respective field.

EXTERNAL RECOGNITION AND RESEARCH AWARDS

The quality of my research endeavors is reflected by the external recognition and research awards it has received. This has been at multiple levels, including recognition from journals publishing my work, media coverage of my work, and international, national, local, campus and school recognition.

Recognition from journals

External recognition of the impact of my work has been provided by journal editors. One study (CV publication #28) was selected to be accompanied by an editorial in its respective journal issue (**Appendix 36**), while another study (CV publication #27) was selected to be focus of an editorial published in the ‘Research Highlights’ section of *Nature Clinical Practice Rheumatology* (3rd ranked journal in the ‘Rheumatology discipline’) (**Appendix 35**). Journal editors also selected three of my research publications (CV publications #13, #16 and #50) to be featured on the cover of their respective journal issues (**Appendix 43**), while another publication (CV research publication #43) was designated as the ‘Leading Article’ in its journal issue.

A number of my publications have been listed in ‘The 50 Most-Frequently Read Articles’ in their respective journals following their publication. Most significantly, my first-author research paper on the negative skeletal effects of commonly prescribed anti-depressant drugs (CV publication #10) remained in the top 10 most read articles for 2 yrs following publication despite over 1000 articles being published in the interim (**Appendix 20**). Similarly, my first-author research paper on the effects of low-intensity pulsed ultrasound therapy and NSAIDs during ligament healing (CV publication #16) was the third most-frequently read article in the leading sports medicine journal *American Journal of Sports Medicine* in July 2006 (**Appendix 33**). Likewise, my first-author research paper on the effects of low-intensity pulsed ultrasound therapy during fracture healing (CV publication #18) was in the top-20 most-frequently read article in the leading rehabilitation journal *Physical Therapy* in August 2006.

Table 3. Journal stature*

Title	Impact factor	Standing
Arthritis & Rheumatism: Arthritis Care and Research	6.8	Ranked in top 4% of all journals (225 out of 6598) 2 nd ranked journal in Rheumatology (out of 22) Most cited journal in Rheumatology (out of 22)
Biomaterials	6.6	Ranked in top 4% of all journals (231 out of 6598) 2 nd ranked journal in Engineering (Biomedical) (out of 51) Most cited journal in Engineering (Biomedical) (out of 51)
Journal of Bone and Mineral Research	6.4	Ranked in top 4% of all journals (251 out of 6598) Top-ranked journal in bone research 7 th most cited journal in Endocrinology & Metabol. (out of 93)
Journal of Biological Chemistry	5.5	4 th most cited journal in all fields and disciplines Ranked in top 5% of all journals (323 out of 6598)
Endocrinology	4.9	Ranked in top 7% of all journals (416 out of 6598) 2 nd most cited journal in Endocrinology & Metabol. (out of 93)
Bone	4.1	Ranked in top 10% of all journals (601 out of 6598)
Rheumatology	4.1	7 th ranked journal in Rheumatology (out of 22) Ranked in top 10% of all journals (603 out of 6598) 4 th most cited journal in Rheumatology (out of 22)
American Journal of Physiology: Endocrinology and Metabolism	3.9	7 th most cited journal in Physiology (out of 74) 14 th ranked journal in Physiology (out of 74)
Journal of Applied Physiology	3.7	Top-ranked journal in Sport Sciences (out of 71) Most cited journal in Sports Sciences (out of 71) 3 rd most cited journal in Physiology (out of 74)
American Journal of Sports Medicine	3.6	2 nd ranked journal in Sport Sciences (out of 71) 2 nd ranked journal in Orthopedics (out of 49) 4 th most cited journal in Sports Sciences (out of 71)
Journal of Cellular Biochemistry	3.5	Ranked in top 13% of all journals (825 out of 6598)
Menopause	3.5	8 th ranked journal in Obstetrics and Gynecology (out of 61)
Medicine and Science in Sport and Exercise	3.4	4 th ranked journal in Sport Sciences (out of 71) 2 nd most cited journal in Sports Sciences (out of 71)
Journal of Biomechanics	2.8	2 nd most cited journal in Engineering (Biomedical) (out of 51)
Sports Medicine	3.0	5 th ranked journal in Sport Sciences (out of 71)
Journal of Orthopaedic Research	3.0	4 th ranked journal in Orthopedics (out of 49) 6 th most cited journal in Orthopedics (out of 49)
Physical Therapy	2.2	2 nd most cited journal in Rehabilitation (out of 28) 4 th ranked journal in Rehabilitation (out of 28)

*Listed according to impact factor, as determined from the Science Edition of the 2008 ISI Journal Citation Reports [v.4.5]

Media coverage

My work has received considerable interest within the general population, as indicated by its wide dissemination within the media. It has received national coverage in all forms of media, including radio, television, print and electronic. For instance, my work on selective serotonin reuptake inhibitors and bone accrual during growth (CV publication #10) was the leading health story on the CBS News homepage (**Appendix 19**), and was featured on the web pages of WebMD, Fox News, Dr. Koop, as well as over 500 other web pages. In addition, it was featured on WFYI Public Radio's 'Sound Medicine' program (**Appendix 44**), as well as over 30 other radio and television programs across the nation. The results of my work on ultrasound therapy and anti-inflammatory drug effects on ligament healing (CV publication #16) were featured by Paul Harvey in his 'News and Comment' radio segment which is syndicated globally to over 1200 radio stations, and was covered by Reuters Health (**Appendix 34**). My work on the life-long effects of exercise during growth (CV publication #22) was featured in the 'Indianapolis Star' (**Appendix 28**) and 'L.A. Health News' (**Appendix 27**). In addition, it received a one page feature in 'Diario Médico' (**Appendix 25**), the biggest medical publication in Spain with a daily circulation of over 70,000 people in the health sector, and was covered in the magazine 'First for Women' which has a national readership of 2 million people (**Appendix 26**). Finally, my work on the efficacy of taping the patellofemoral joint for the management of chronic knee pain (CV publication #27) was covered by Reuters Health (**Appendix 41**) and was featured in the mainstream international magazine 'Men's Health' (**Appendix 42**). This external recognition from the media indicates that my work is of broad and translatable impact. This is further reflected by the request from the media to discuss other topics including the benefits of knee bracing for arthritis (**Appendix 45**) and stress fractures (**Appendix 46**).

International recognition

In addition to international media coverage, my work has received international recognition from my scientific peers. Most notably, my study investigating the effect of low-intensity pulsed ultrasound and a non-steroidal anti-inflammatory drug on ligament healing was awarded an international research award (ASICS Award for Best Young Investigator, 2005 Australian Sports Medicine Federation Fellows Awards) (**Appendix 13**) and I received an ASBMR-Harold Frost Young Investigator Award (35th International Sun Valley Workshop on Skeletal Tissue Biology) for my body of work investigating the skeletal effects of mechanical loading/exercise (**Appendix 35**). I was also invited to provide three international oral presentations while in rank.

National recognition

While in rank my work has received national recognition at scientific meetings. This has included the award of new or young investigator awards from the Orthopaedic Research Society, Advances in Mineral Metabolism, American Society of Bone Mineral Research, and American College of Sports Medicine. These are all highly competitive awards, with the last one being particularly prestigious as it is awarded to only two individuals per year and is given for a body of work an investigator has contributed as opposed to the results of a single data set (**Appendix 30**). In addition, I have been invited to give 14 national oral presentations while in rank, including presentations at large scientific conferences (Annual Meetings of the American Society of Bone and Mineral Research and American College of Sports Medicine, and Combined Sections Meeting of the American Physical Therapy Association) (**Appendix 47**) and smaller specialty meetings (7th Annual Bone day at the University of Cincinnati and State of the Science Stress Fracture Research Conference held by the U.S. Army Medical Research and Materiel Command). I was also one-of-two clinician scientists to participate in the first 'Podcast Debate' for the American Physical Therapy Association's journal *Physical Therapy* (**Appendix 48**). As a result of my cumulative work, I was advanced to level of 'Fellow' within the American College of Sports Medicine (**Appendix 49**).

Local, campus and school recognition

My scholarly activities have been recognized in various forms locally, on campus and within my school. Locally, I have been one-of-ten finalist in the Health and Life Sciences section of Indy's Best and Brightest Awards for the previous three years (2006-2008). On campus, I have been recognized with an 'Outstanding

Faculty Award' (**Appendix 50**), an adjunct appointment within the Department of Anatomy and Cell Biology (IU School of Medicine) which has recently been renewed (**Appendix 51**), acknowledgement by the Chancellor in his 2008 'State of the Campus' address (**Appendix 52**), and featured in the 'IUPUI Magazine' (**Appendix 53**), on the 'Indiana University' (Bloomington) homepage (**Appendix 54**), on the 'Research at Indiana University' website (**Appendix 55**), and on the 'IU Homepages' (**Appendix 56**). In addition, my work was featured in a podcast entitled 'Space Exploration Hazards' that was completed for the IUPUI website (**Appendix 57**), and was invited to give presentations during the IUPUI Research Day 2009 and to the Indiana Bone and Mineral Club. Within my school, my scholarly activities have been recognized with an honorary appointment as Director of Research within the Department of Physical Therapy (**Appendix 58**), and was twice awarded the Excellence Award in Research from the School of Health and Rehabilitation Sciences (2006 and 2007).

INDIVIDUAL CONTRIBUTIONS TO COLLABORATIVE WORK

The following table details active collaborations I currently participate in. Collaborators are listed alphabetically and respective contribution to the collaborative work is provided.

Collaborator	Contribution to collaborative work
<p>Michael M. Bliziotis, MD Associate Professor, Department of Medicine, Oregon Health and Science University Section Chief of Endocrinology, Portland Veterans Administration Medical Center</p>	<p>Dr. Bliziotis is nationally-recognized for his contribution to the understanding of the skeletal effects of selective serotonin reuptake inhibitors which are widely-used antidepressant agents. We collaborate on studies in this area of inquiry, with Dr. Bliziotis performing <i>in vitro</i> cellular and clinical studies and I performing translational animal-based studies.</p> <p>This collaboration has yielded a successful NIH R01 grant application on which I am co-investigator, two published research papers on which I am first and corresponding author (CV publications #10, 29), two published review papers on which I am first and corresponding author (CV publications #47 and 50), one published review paper on which I am a co-author (CV publication #48), and one research paper that has been recently submitted for publication on which I am first and corresponding author (CV publication #34). Most recently, I submitted an NIH R01 funding application as PI with Dr. Bliziotis listed as a consultant.</p>
<p>David B. Burr, PhD Professor and Chairman, Department of Anatomy and Cell Biology, Indiana University School of Medicine</p>	<p>Dr. Burr is internationally-recognized as a leader in the study and understanding of bone morphology. We collaborate on studies investigating bone injuries, including complete bone fractures and stress fractures. Dr. Burr acts as a consultant on our studies and is involved in data interpretation.</p> <p>Our collaboration has yielded a successful grant application to the U.S. Army Medical Research and Materiel Command, a published research paper on which I am first and corresponding author (CV publication #13), a published research paper on which I am last/senior author (CV publication #26), a published review paper on which I am first and corresponding author (CV publication #52), and a book chapter on which I am first author (CV publication #65). Most recently, our collaboration was awarded a subcontract from the National Space Biomedical Research Institute to perform studies in collaboration with Cleveland Clinic on bone healing in a weightless environment. I am PI on this subcontract with Dr. Burr being listed as a co-investigator.</p>

Kay M. Crossley, PT, PhD

Principal Research Fellow,
Department of Mechanical
Engineering, Melbourne School of
Engineering, University of
Melbourne (Australia)

Dr. Crossley is an internationally-recognized physical therapist and researcher in the area of sports medicine. We collaborate on a range of projects in this area and have recently completed a randomized clinical trial and meta-analysis. Dr Crossley directly supervises a research assistant who organizes the projects, while I provide distant supervision, problem-solving, data processing and interpretation, and manuscript preparation and submission.

Our collaboration has yielded a successful grant application to the Australian Sports Commission, four published research papers on which I am first and corresponding author (CV publications #9, 23, 27, 28), one published research paper on which I am senior/last and corresponding author (CV publication #25), one published review paper on which I am first and corresponding author (CV publication #53), and one published research paper on which I am a co-author (CV publication #8). In addition, Dr. Crossley and I are currently preparing two additional research papers which will be submitted soon.

Robyn K. Fuchs, PhD

Assistant Professor, Department of
Physical Therapy, Indiana
University

Dr. Fuchs works within the same department, and has very similar research interests into the study of bone health and, in particular, the skeletal effects of exercise. We regularly meet to discuss research ideas and directions, and work together to complete translational animal-based studies.

Our collaboration has yielded three published research papers on which I am first and corresponding author (CV publications #18, 22, 29), two published review papers on which I am first and corresponding author (CV publication #49 and 51), one published review paper on which I am co-author (CV publication #54), two published editorials on which I am first and corresponding author (CV publications #59 and 61), one book chapter on which I am co-author (CV publication #66), and one research paper that has been recently submitted for publication on which I am first and corresponding author (CV publication #34). In addition, I am listed as a consultant on Dr. Fuchs' funded NIH K01 award and most recently I submitted an NIH R01 funding application as PI with Dr. Fuchs listed as a co-investigator.

Meredith R. Golomb, MD, MS

Associate Professor, Department of
Neurology, Indiana University
School of Medicine

Dr. Golomb is a clinician researcher with a particular interest in pediatric neurology. She came to me in 2007 for assistance with her studies investigating the efficacy of virtual reality telerehabilitation in the management of hand deficits associated with pediatric cerebral palsy. In addition to providing methodological assistance, I have been providing bone health assessments of Dr. Golomb's subjects. Our collaboration has thus far yielded a research that has been submitted for publication on which co-author (CV publication #33). In addition, I am listed as a co-investigator on Dr. Golomb's submitted NIH R01 funding application.

Ronald J. Midura, PhD

Associate Staff, Department of
Biomedical Engineering and
Orthopaedic Research Center,
Cleveland Clinic

Dr. Midura is a biomedical engineer with interests in the musculoskeletal effects of space exploration. He came to me in 2007 for assistance with his planned studies into the efficacy of low-intensity pulsed ultrasound as a countermeasure for altered bone healing in a weightless environment. Our collaboration has thus far yielded a funded grant application from the National Space Biomedical Research Institute. I am PI on a subcontract associated with the grant.

Greg A. Merrell, MD

Surgeon, The Indiana Hand Center

Dr. Merrell is a board certified hand surgeon with research interests in arthritis, fracture healing and tendon repair. He came to me in 2008 for assistance with studies into the repair of lacerated finger flexor tendons using a knotless barbed suture. In collaboration with Dr. Merrell's resident fellow (Dr. Ian Marrero), I devised and performed destructive mechanical tests of cadaver flexor tendons to investigate the efficacy of the new suture technique. Our collaborative effort currently has one research paper in preparation (CV publication #41).

Charles H. Turner, PhD

Chancellor's Professor and Associate Director, Department of Biomedical Engineering, Purdue School of Engineering and Technology, IUPUI

Dr. Turner is an internationally-recognized expert in bone health and was my post-doctoral fellowship supervisor from 2002-2004. I have continued my collaboration with Dr. Turner while 'in rank' and he is actually the main reason I decided to stay at IU as opposed to moving to another institution. Dr. Turner primarily acts as a consultant on collaborative efforts, and also provides valuable the lab space and equipment required to complete my research endeavors.

Our ongoing collaboration has yielded a successful NIH R01 grant application on which I am co-investigator and 20 published papers on which I am frequently (50% of the time) first and corresponding author (CV publications #7, 10-15, 17, 19-22, 24, 29, 47, 49-51, 56, 66). Dr. Turner is listed as a co-investigator or consultant on all of my submitted NIH funding applications.

Dr. Turner and I have strong collaborative links; however, my line of inquiry and body of work has become relatively independent of his. This is evident by the fact that of my 10 most recently published research publications, Dr. Turner is a co-author on only two (20%). Similarly, Dr. Turner will be a co-author on only two of the 10 research publications I currently have submitted or in preparation.

Connie M. Weaver, PhD

Distinguished Professor and Head, Department of Food and Nutrition, Purdue University

Dr. Weaver is an internationally-recognized leader in bone health and the role of nutrition. She came to me in 2007 for assistance with a study investigating the impact of three serves of dairy on bone health and body composition in normal and overweight adolescents. This study aims to recruit 240 subjects (120 at each of the Purdue and Indiana University sites) and is funded by the National Dairy Council. My role is to provide bone health, body composition and anthropometric measures on the subjects recruited to the Indiana University site, and provide expertise and oversight in terms of the execution of these measures at both sites.

ACTIVITIES TO ADVANCE PROFESSIONAL KNOWLEDGE

I have attended a total of 20 national and international professional scientific conferences and workshops since appointment. These have been highly successful avenues for expanding my scientific knowledge, incubating new scientific ideas, keeping abreast of the latest directions within my fields of inquiry, presenting and receiving feedback regarding my own scientific endeavors, and establishing new and strengthen existing collaborations.

CURRICULUM VITAE

Stuart J. Warden, PT, PhD, FACSM

**All sections are while 'in rank', except for education*

EDUCATION

Undergraduate

1994–1997 Bachelor of Physiotherapy (Honours)
School of Physiotherapy, The University of Melbourne, Australia

Postgraduate

1998–2001 Doctor of Philosophy (Physiotherapy)
School of Physiotherapy, The University of Melbourne, Australia
Thesis title: The skeletal effects of low-intensity pulsed ultrasound
Principal supervisor: Kim L. Bennell, PT, PhD

Postdoctoral

2001 Clinical Post-Doctorate
Centre for Sports Sciences and Sports Medicine, Australian Institute of Sport, Australia
Principal supervisor: Craig R. Purdam, PT, MS, FASMF

2002–2004 Research Post-Doctorate
Department of Orthopaedic Surgery, Indiana University School of Medicine, USA
Principal supervisor: Charles H. Turner, PhD

ACADEMIC APPOINTMENTS

2001–present Fellow (Lecturer level), Centre for Health, Exercise and Sports Medicine, School of Physiotherapy, The University of Melbourne, Australia
2004–present Assistant Professor (Tenure track), Department of Physical Therapy, School of Health and Rehabilitation Sciences, Indiana University, IN
2005–present Adjunct Assistant Professor, Department of Anatomy and Cell Biology, Indiana University School of Medicine, Indiana University, IN
2006–present Director of Research, Department of Physical Therapy, School of Health and Rehabilitation Sciences, Indiana University, IN

LICENSURES AND CERTIFICATIONS

1997–present Physiotherapists Registration Board of Victoria (Australia) [Registration #7590]

PROFESSIONAL ORGANIZATIONS

2001–present Member, International Bone and Mineral Society
2002–present Member, American College of Sports Medicine
2003–present Member, American Society of Bone and Mineral Research
2005–2006 Member, Sports Medicine Australia
2008 Member, Osteoarthritis Research Society International

HONORS AND AWARDS

Awarded to self

- 2004 New Investigator Recognition Award, 50th Annual Meeting of the Orthopaedic Research Society
- 2005 AIMM-ASBMR John Haddad Young Investigator Award, Advances in Mineral Metabolism-American Society of Bone Mineral Research John Haddad Young Investigators Meeting
ASBMR-Harold Frost Young Investigator Award, 35th International Sun Valley Workshop on Skeletal Tissue Biology
ASICS Award for Best Young Investigator, 2005 Australian Sports Medicine Federation Fellows Awards
- 2006 ACSM 2006 New Investigator Award (Clinical Science), 53rd American College of Sports Medicine Annual Meeting
Finalist, Indy's Best & Brightest Awards (Health & Life Sciences), Junior Achievement of Central Indiana, Inc. and KPMG, LLP.
Excellence Award in Research, School of Health and Rehabilitation Sciences, Indiana University
- 2007 Fellowship, American College of Sports Medicine
Finalist, Indy's Best & Brightest Awards (Health & Life Sciences), Junior Achievement of Central Indiana, Inc. and KPMG, LLP.
Outstanding Faculty Award, Indiana University–Purdue University Indianapolis, Indianapolis
Excellence Award in Research, School of Health and Rehabilitation Sciences, Indiana University
Sigma Xi Membership, The Scientific Research Society
- 2008 Finalist, Indy's Best & Brightest Awards (Health & Life Sciences), Junior Achievement of Central Indiana, Inc. and KPMG, LLP.

Awarded to student/others

- 2005 Mary McMillan Scholarship, American Physical Therapy Association (awarded to Keith G. Avin in part for work completed within Dr. Warden's research laboratory)
New Investigator Recognition Award, 51st Annual Meeting of the Orthopaedic Research Society (awarded to Kimihiko Sawakami, MD, for work completed in collaboration with and co-authored by Dr. Warden)
- 2007 William and Fern Groves Hardiman Scholarship, Indiana University School of Medicine (awarded to Ian R. Nelson for work completed within Dr. Warden's research laboratory as part of the 'Summer Research in Academic Medicine' program)
Alice L. Jee Memorial Young Investigator Award, 37th International Sun Valley Workshop on Skeletal Tissue Biology, Sun Valley, ID (awarded to David E. Komatsu, PhD, for work completed as part of post-doctorate studies with Dr. Warden)
- 2009 Finalist, New Investigator Recognition Award, 55th Annual Meeting of the Orthopaedic Research Society (awarded to David E. Komatsu, PhD, for work completed as part of post-doctorate studies with Dr. Warden)

TEACHING ASSIGNMENTS

Graduate (Indiana University)

- P541—Musculoskeletal Practice Patterns I (4 cr.)
 - Course coordinator and primary instructor
Spring 2005–present
- P622—Musculoskeletal Practice Patterns II (4 cr.)
 - Course coordinator and primary instructor
Fall 2005–present
- P513—Functional Anatomy and Clinical Biomechanics
 - Guest lecturer for 'Shoulder mechanics' (2 hour lecture)
Fall 2004–2007
- P646—Introduction to Therapeutic Interventions
 - Guest lecturer and instructor for 'Ultrasound therapy' (1 hour lecture and 2 hour laboratory)
Spring 2005–present

- P645—Evidenced-Based Critical Inquiry II
 - Guest lecturer & discussion panel member for ‘Module 5: fellowships and faculty’ (1 hour lecture) Fall 2005–2007
 - Guest lecturer for ‘Inferential statistics’ (2 hour lecture) Fall 2008

Research student supervision

(‘Publications’ indicate published or ‘in press’ manuscripts and abstracts co-authored with student)

Post-doctoral fellows

Fellow	Dates	Role	Current position	Publications	
				Abstracts	Manuscripts
David E. Komatsu, PhD	7/06-6/08	Primary mentor	Senior Scientist/Manager, Biologics & Biomaterials Laboratory, InMotion Musculoskeletal Institute, Memphis, TN	4	2 ^A

^AOne additional paper submitted

Graduate students

Student/Degree	Dates	Department	Topic	Role	Publications	
					Abstracts	Manuscripts
Alistair B. T. Ooi/ BMedSci	2004	School of Physiotherapy, University of Melbourne	Usefulness of imaging in patellar tendinopathy	Co-supervisor	3	1
Kaviraj Thancanamootoo/ BMedSci	2004	School of Physiotherapy, University of Melbourne	Physical impairments in patellar tendinopathy	Co-supervisor	1	1
M. Terry Loghmani/PhD	2004– (part-time student)	Department of Anatomy and Cell Biology, IU School of Medicine	Instrumented cross-fiber massage in the treatment of ligament injuries	Committee chair	3	1
Neal Dollin/MS	2009–	Department of Anatomy and Cell Biology, IU School of Medicine	Contribution of muscle to bone and tendon morphology	Primary advisor	-	-

STEM (science, technology, engineering and math) Initiative participant

Trainee Name	Year	Home institution	Publications	
			Abstracts	Manuscripts
Anthony R. Gutierrez	2008	Purdue University	1	1

Doctor of Medicine summer students (‘Summer Research in Academic Medicine’ program)

Student	Year	Publications	
		Abstracts	Manuscripts
Megan S. Sanders	2004	3	2
Christopher K. Kessler	2005	1	1
Ian R. Nelson	2006	-	2
Paul Critser	2006	-	-

Doctor of Physical Therapy research assistants

Student	Dates	Publications	
		Abstracts	Manuscripts
Keith G. Avin	2004-05	6	3
Molly A. Hagemeyer	2005	3	1
Kristen M. Martin	2005	3	1
Marie E. DeWolf	2005	3	1
Erin M. Beck	2005	3	1
Ryan E. Cardinal	2005	1	1
Andrew Bauermeister	2005	-	-
John Kiesel	2005	1	-
Bobby Lassiter	2006	1	-
Lynn Taylor	2006	1	-
Johanna Rydberg	2007	2	1 ^B
Sean M. Hassett	2007-08	2	1 ^B
Julie L. Bond	2007	2	1 ^B
Elizabeth D. Bogenschutz	2008-	3	1 ^B
Heather D. Smith	2008-	2	1 ^B

^BOne additional paper submitted

Undergraduate student research assistant

Student	Year	Home institution	Publications	
			Abstracts	Manuscripts
Lauren Waugh	2004	Franklin College	1	1

PROFESSIONAL SERVICE

Service to the discipline

Committee membership

2008– Member, Research and Development Committee, Rehabilitation Hospital of Indiana Foundation

Grant review board membership

2005 Member, Research Advisory Committee for Research Support Funds Grant Applications, Office of the Vice Chancellor for Research and Graduate Education, Indiana University

2006–2008 Member, Merit Review and Evaluation Board, Rehabilitation Research and Development Service, Department of Veteran Affairs

2007 Member, National Institute of Biomedical Imaging and Bioengineering Special Emphasis Panel, Training and Career Award Review (Study section–ZEB1 OSR-B)

2008 Ad-hoc member, Movement and Exercise Committee Peer Review Meeting, Canadian Institutes of Health Research

Member, National Institute of Biomedical Imaging and Bioengineering Special Emphasis Panel, Ultrasound Therapy (Study section–ZEB1 OSR-B [O1])

Technical Reviewer, Lifesciences I Panel, National Science Foundation Small Business Innovation Research (NSF SBIR) Panels

Member, Indiana Spinal Cord and Brain Injury Fund Scientific Review Committee, Indiana State Department of Health

Editorial board membership for scientific journals

2005–present Journal of Science and Medicine in Sport
2006–present British Journal of Sports Medicine (Associate Editor, 2009–present)
2007–present Journal of Orthopaedic and Sports Physical Therapy

Ad hoc reviewer of grant applications

(Parentheses indicate number of grants reviewed for agency while in rank)

Austrian Science Fund (Fonds zur Förderung der wissenschaftlichen Forschung [FWF]), Austria (1)
Biomedical Research Council, Agency for Science, Technology and Research, Singapore (1)
Canadian Institutes of Health Research, Canada (2)
Department of Veteran Affairs, U.S.A. (17)
Indiana Spinal Cord and Brain Injury Fund, Indiana State Department of Health, U.S.A. (4)
Leaders Opportunity Fund, Canadian Foundation of Innovation, Canada (1)
Medical Research Council of the United Kingdom, U.K. (1)
National Institute of Biomedical Imaging and Bioengineering, National Institutes of Health, U.S.A. (6)
National Science Foundation, U.S.A. (7)
Netherlands Organisation for Health Research and Development, Netherlands (1)
Physiotherapy Research Foundation, Australian Physiotherapy Association, Australia (1)
Research Grants Council of Hong Kong, Hong Kong (4)
Research Support Funds Grants, Indiana University, U.S.A. (7)
Thrasher Research Fund, U.S.A. (1)
United States Army Research and Materiel Command, U.S.A. (3)

Ad hoc reviewer of scientific book

Woo SL-Y, Renström PAFH and Arnoczky SP (eds.): Tendinopathy in Athletes: Volume XII of the Encyclopaedia of Sports Medicine (2007) [Reviewed for Doody's Book Review Service]

Ad hoc reviewer of manuscripts for scientific journals

(Parentheses indicate number of manuscripts reviewed for journal while in rank)

Acta Pharmacologica Sinica (1)
Australian Journal of Physiotherapy (2)
American Journal of Physiology—Regulatory, Integrative and Comparative Physiology (1)
American Journal of Sports Medicine (4)
Annals of Biomedical Engineering (1)
BioMedical Engineering OnLine (1)
BMC Musculoskeletal Disorders (1)
BMC Physiology (1)
Bone (26)
British Journal of Nutrition (1)
British Journal of Sports Medicine (8)
Calcified Tissue International (11)
Canadian Journal of Physiology and Pharmacology (1)
Clinical Journal of Sports Medicine (4)
Connective Tissue Research (1)
European Journal of Physical and Rehabilitation Medicine (1)
Experimental Biology and Medicine (1)
Expert Review of Endocrinology and Metabolism (1)
Gender Medicine (1)
Hormone and Metabolic Research (1)
International SportMed Journal (1)
Journal of Applied Physiology (9)
Journal of Biomechanical Engineering (2)
Journal of Biomedical Science and Engineering (1)
Journal of Bone and Mineral Research (2)
Journal of Clinical Densitometry (1)
Journal of Orthopaedic and Sports Physical Therapy (15)

Department of Physical Therapy service

Student Advising Program
Advisor (2004–present)

Student Mentoring Program
Founder and Lead Faculty Contact (2005-2008)
Faculty Contact for Anatomy and Biomechanics (2005–present)

‘Seminars in Physical Therapy’ program
Initiator and Convener (2006–present)

‘Forward Motion’ (Department of Physical Therapy) newsletter
Founding Editor-in-chief (2006–2008)

Director of Research
2006–present

OTHER PROFESSIONAL ACTIVITIES

Media interviews

1. Phone interview with *HealthDay* (consumer health news provider) on the potential negative effects of antidepressants on bone health (November 5th, 2004)
2. Phone interview with *WebMD* on the potential negative effects of antidepressants on bone health (November 9th, 2004)
3. Phone interview with *NBC News* on the potential negative effects of antidepressants on bone health (November 11th, 2004)
4. In-studio interview with *WFYI 90.1 FM* for the ‘Sound Medicine’ program on the potential negative effects of antidepressants on bone health (November 9th, 2004)
5. Phone interview with *Reuters Health* on the beneficial effects of ultrasound therapy and negative effects of NSAIDs following ligament injury (July 19th, 2006)
6. Phone interview with *Reuters Health* on the life-long skeletal benefits of exercise during growth (December 6th, 2006)
7. Phone interview with *WFYI 90.1 FM* on the life-long skeletal benefits of exercise during growth (December 8th, 2006)
8. Web-based interview with *Diario Médico* on the life-long skeletal benefits of exercise during growth (December 12th, 2006)
9. Web-based interview with *First for Women* magazine on the life-long skeletal benefits of exercise during growth (January 9th, 2007)
10. Phone interview with *Indianapolis Star* on knee bracing for osteoarthritis (October 16th, 2007)
11. Web-based interview with *Reuters Health* on the effects of patellar taping and bracing for the treatment of chronic knee pain (February 15th, 2008)
12. Web-based interview with *Men’s Health* on the effects of patellar taping and bracing for the treatment of chronic knee pain (April 17th, 2008)
13. Web-based interview with *Today in PT* on lower extremity stress fractures in adolescent athletes (August 29th, 2008)

Invited oral presentations

International

1. Ultrasound therapy works!—A new direction for ultrasound in sports medicine. Australian Conference of Science and Medicine in Sport, Melbourne, VIC, Australia (2005)
2. Is exercise during growth beneficial to osteoporotic fracture risk? Australian Conference of Science and Medicine in Sport, Melbourne, VIC, Australia (2005)

3. Use and effects of instrument-assisted soft tissue massage. 13th Annual Soft Tissue Injury Forum, Olympic Park Sports Medicine Centre, Melbourne, VIC, Australia (2005)

National

4. Cortical bone augmentation with mechanical loading is best at a loading frequency of 10 Hz. 2004 Society for Experimental Mechanics X International Congress & Exposition on Experimental and Applied Mechanics, Costa Mesa, CA (June 7th-9th, 2004)
5. Short- and long-term effects of mechanical loading on the skeleton. Advances in Mineral Metabolism/American Society of Bone and Mineral Research John Haddad Young Investigators' Meeting. Snowmass, CO (2005).
6. Mechanical loading during growth has long-term benefits to skeletal health. 35th International Sun Valley Hard Tissue Workshop, Sun Valley, ID (2005)
7. Epidemiology and clinical risk factors for stress fractures. American Society of Bone and Mineral Research 27th Annual Scientific Meeting, Nashville, TN (2005)
8. Stress fractures. The 7th Annual Bone Day: Modern Approaches to Diagnosis & Treatment of Osteoporosis, University of Cincinnati, OH (April 7th, 2006)
9. What is the role for bone stimulators? Highlighted symposium: 'When bone fails from activity: optimizing evaluation and management'. 53rd Annual Meeting of the American College of Sports Medicine, Denver, CO (2006)
10. Bone overuse injuries. Advances in Mineral Metabolism/American Society of Bone and Mineral Research John Haddad Young Investigators' Meeting, Snowmass, CO (April 10th, 2007)
11. Stress fractures. Osteoporosis: A Health Concern for All Generations, University of Cincinnati, OH (October 19th, 2007)
12. Medical loading and stress fractures. State of the Science Stress Fracture Research Conference, Bone Health and Military Medicine Research Program, US Army Medical Research and Materiel Command, Columbia, SC (Feb 6th, 2008)
13. Pathophysiology and risk factors for stress fractures. Education session: 'Evidenced-based prevention and treatment of lower extremity stress fractures'. American Physical Therapy Association Combined Sections Meeting, Nashville, TN (Feb 7th, 2008)
14. Treatment of stress fractures. Education session: 'Evidenced-based prevention and treatment of lower extremity stress fractures'. American Physical Therapy Association Combined Sections Meeting, Nashville, TN (Feb 7th, 2008)
15. What features of a mechanical load are important to bone adaptation? Education session: 'Skeletal effects of exercise/mechanical loading across the lifespan: evidence from basic science and clinical studies'. American Physical Therapy Association Combined Sections Meeting, Las Vegas, NV (Feb 11th, 2009)
16. Methods of assessing the skeletal effects of exercise. Education session: 'Skeletal effects of exercise/mechanical loading across the lifespan: evidence from basic science and clinical studies'. American Physical Therapy Association Combined Sections Meeting, Las Vegas, NV (Feb 11th, 2009)
17. Exercise in the elderly: stand up straight and don't fall over. Education session: 'Skeletal effects of exercise/mechanical loading across the lifespan: evidence from basic science and clinical studies'. American Physical Therapy Association Combined Sections Meeting, Las Vegas, NV (Feb 11th, 2009)

Local

18. Tendon overuse injuries. Riverview Health and Fitness, Noblesville, IN (January 20th, 2006)
19. A new direction for ultrasound therapy in rehabilitation. Department of Anatomy and Cell Biology Seminar Series, Indiana University, Indianapolis, IN (January 24th, 2006)
20. Exercise during growth has life-long benefits on bone health. Indiana Bone and Mineral Club meeting, Indiana University, Indianapolis, IN (February 7th, 2007)
21. Ultrasound therapy. REBOUND Rehabilitation and Sports Medicine, Bloomington, IN (November 29th, 2007)
22. Ultrasound therapy. St Francis Sports Medicine, Indianapolis, IN (June 26th, 2008)
23. Stress fractures. St Francis Sports Medicine, Indianapolis, IN (Oct 23rd, 2008)

24. Exercise during growth builds bigger (and stronger) bones for a lifetime. IUPUI Research Day 2009, Indianapolis, IN (April 24th, 2009)

Peer-reviewed oral presentations

International

25. The higher incidence of anterior cruciate ligament injuries in females is not due to direct ligament effects of estrogen. Australian Conference of Science and Medicine in Sport, Melbourne, VIC, Australia (2005)
26. Knee ligament healing is accelerated by low-intensity pulsed ultrasound and delayed by a non-steroidal anti-inflammatory drug. Australian Conference of Science and Medicine in Sport, Melbourne, VIC, Australia (2005)

National

27. Cortical bone augmentation with mechanical loading is best at a loading frequency of 10 Hz. 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA (2004)
28. Inhibition of the serotonin transporter using an anti-depressant drug (fluoxetine hydrochloride) decreases bone mineral accrual during growth. 51st Annual Meeting of the Orthopaedic Research Society, Washington, DC (2005)
29. Bone adaptation to a mechanical loading program significantly increases skeletal fatigue resistance. 52nd Annual Meeting of the American College of Sports Medicine, Nashville, TN (2005)
30. Mechanical loading during growth has long-term benefits to skeletal health. American Society of Bone and Mineral Research 27th Annual Scientific Meeting, Nashville, TN (2005)
31. Knee ligament healing is accelerated by low-intensity pulsed ultrasound and delayed by a non-steroidal anti-inflammatory drug. American Physical Therapy Association Combined Sections Meeting, San Diego, CA (2006)
32. Ultrasound produced by a conventional therapeutic ultrasound unit accelerates fracture repair. 53rd Annual Meeting of the American College of Sports Medicine, Denver, CO (2006)
33. Exercise during growth has lifelong benefits to skeletal health. 53rd Annual Meeting of the American College of Sports Medicine, Denver, CO (2006)
34. Knee ligament healing is accelerated by low-intensity pulsed ultrasound and delayed by a non-steroidal anti-inflammatory drug. 53rd Annual Meeting of the American College of Sports Medicine, Denver, CO (2006)
35. Parathyroid hormone and low-intensity pulsed ultrasound have additive beneficial effects during fracture healing. 55th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN (2008)

Peer-reviewed poster presentations

International

36. Patellar taping and bracing for the treatment of chronic knee pain: a systematic review and meta-analysis. Osteoarthritis Research Society International 2007 World Congress on Osteoarthritis, Fort Lauderdale, FL, USA (6-9 December 2007)
37. Psychotropic drugs have contrasting skeletal effects that are independent of their negative effects on activity levels. American Society of Bone and Mineral Research 30th Annual Scientific Meeting, Montréal, Québec, Canada (12-16 September 2008)

National

38. Serotonin (5-HT) influences bone mass, size and strength, but is not involved in mechanotransduction. 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, USA. 2004
39. Bone adaptation to a mechanical loading program significantly increases skeletal fatigue resistance. 51st Annual Meeting of the Orthopaedic Research Society, Washington, DC, USA. 2005
40. Sensitivity and specificity of diagnostic imaging techniques for patellar tendinopathy. 52nd Annual Meeting of the American College of Sports Medicine, Nashville, TN, USA. 2005
41. The higher incidence of knee ligament injuries in females is not due to direct ligament effects of estrogen. American Physical Therapy Association Combined Sections Meeting, San Diego, CA, USA. 2006

GRANTS AND FELLOWSHIPS

Active grant support

Funding agency	Title	Role	Dates	Amount
National Space Biomedical Research Institute (MA01604)	Extent, causes, and countermeasures of impaired fracture healing in hypogravity	Subcontract principal investigator (PI–Warden)	05/01/08-04/30/12	\$338,742 (total award \$1,789,968)
NIH-NIAMS (R01 AR052018)	The function of neurotransmitters in bone biology	Subcontract co-investigator (PI–Turner)	09/20/05-08/31/10	\$608,000 (total award \$1,480,725)
NIH-NIAMS (K01 AR054408)	The role of periostin in bone formation	Consultant (PI–Fuchs)	07/01/08-06/30/13	\$600,857
NIH-NIAMS (K23 AR057096)	FGF23 in pediatric phosphate physiology and X-linked hypophosphatemic rickets	Co-mentor (PI–Imel)	07/01/09-06/30/14	\$598,008

Pending grant support

Funding agency	Title	Role	Dates	Amount
NIH-NIAMS (R01)	Sustainability of exercise-induced increases in bone structure and estimated strength	Principal investigator	01/01/10-12/31/13	\$1,232,000
NIH-NIAMS (R01)	Direct skeletal effects of 5-HT transporter inhibition and LRP5	Principal investigator	06/01/10-05/30/15	\$1,925,000
NIH-NINDS (R01)	Hemiplegic cerebral palsy hand tele-rehabilitation with virtual reality videogames	Co-investigator [PI–Golomb]	12/01/09-11/30/14	\$1,895,190
NIH-NIAMS (R15) <i>Resubmission</i>	Long-term skeletal effects of exercise during growth <i>First submission score: 170 ('excellent') (fundable score ≤160)</i>	Principal investigator	06/01/10-05/30/13	\$231,000
NIH-NCRR (S10)	SkyScan 1173 High Energy Micro-CT	Co-investigator [PI–Williams]	04/01/10-03/31/11	\$336,300
Department of Defense	Secreted Wnt antagonists in disuse-induced osteoporosis	Co-investigator [PI–Robling]	02/01/10-1/31/13	\$1,062,982

Completed grant support while in rank

Funding agency	Title	Role	Dates	Amount
Eli Lilly and Company, Inc.	DXA and pQCT measures in a single-dose, dose-escalation study to evaluate the safety, tolerability, pharmacokinetics, and pharmacodynamics of LY2541546 in healthy postmenopausal women	Principal investigator	06/19/08-03/09/09	\$11,150
Eli Lilly and Company, Inc.	DXA and pQCT measures in a multiple-dose, dose-escalation, safety, tolerability, and pharmacokinetic study of LY2452473 in healthy subjects	Principal investigator	07/01/08-01/02/09	\$14,400
Eli Lilly and Company, Inc.	Investigations into pharmaceutical effects on fracture repair	Principal investigator	12/06/05-12/05/08	\$166,000
Massage Therapy Foundation	Tissue-level efficacy of cross-fiber massage following ligament injury	Principal investigator	01/01/07-12/31/07	\$19,253
NIH-NIAMS (R03 EB005426)	Development of biodegradable, load bearing DBM carrier	Consultant (PI–Chu)	09/01/05-08/31/07	\$147,586

IUPUI Office of the Vice Chancellor for Res. & Grad. Educ.	Development and investigation of a novel animal model of Achilles tendinosis	Principal investigator	01/01/06-12/31/06	\$30,000
US Army Medical Research & Materiel Command	Healing of stress fractures in an animal model	Co-investigator (PI-Li)	09/01/03-08/31/06	\$200,209
IUPUI Office for Prof. Development	Ultrasound and anti-inflammatory drug effects on ligament healing	Principal investigator	01/01/05-12/31/05	\$3,000
Australian Sports Commission	Effect of low-intensity ultrasound on patellar tendinopathy: a randomized controlled trial	Co-investigator (PI-Crossley)	07/01/04-06/30/05	\$40,000

Non-funded grant applications

Funding agency	Title	Role	Dates	Amount
NIH-NCCAM (R01)	Mechanisms for beneficial effects of cross fiber massage during ligament healing <i>First submission: unscored</i>	Principal investigator	06/01/10-05/31/14	\$1,208,000
NIH-NIAMS (R21)	Active blood perfusion for bone healing <i>First submission score: Unscored</i> <i>Second submission score: Unscored</i>	Co-investigator [PI-Yokota]	04/01/10-03/31/14	\$423,500
NIH-NIAMS (R21)	Development of a novel animal model for knee osteoarthritis <i>First submission: unscored</i>	Principal investigator	01/01/08-12/31/09	\$327,500
NIH-NIAMS (R21)	A novel animal model of Achilles tendon degeneration <i>First submission score: 178 ('excellent') (Percentile = 18.1)</i> <i>Second submission score: 171 ('excellent') (Percentile = 20.2)</i>	Principal investigator	08/01/07-07/31/09	\$313,364
NIH-NIAMS (R03)	Long-term skeletal effects of mechanical loading during growth <i>First submission score = 225</i> <i>Second submission score: 171 ('excellent') (fundable score \leq169)</i> <i>Third submission score: 163 ('excellent') (fundable score \leq160)</i>	Principal investigator	08/01/07-07/31/10	\$227,000
NIH-NIAMS (R15)	Ultrasound therapy during fracture repair: effect of dose and drug interactions <i>First submission score = 212 ('very good') (fundable score \leq150)</i>	Principal investigator	07/01/07-06/30/10	\$226,750
NIH-NIAMS (F32)	Lifelong skeletal benefit of exercise during growth <i>First submission: unscored</i>	Sponsor [PI-Mantila Roosa]	01/01/10-12/31/14	\$151,482
NIH-NIAMS (R03)	Estrogen effects on ligament biomechanics <i>Score = 255 ('good') (fundable score \leq150)</i>	Principal investigator	01/01/05-12/31/06	\$150,500
Department of Defense	A novel animal model of Achilles tendon degeneration <i>Score = 2.4 ('very good') (8% of applications funded)</i>	Principal investigator	01/01/06-12/31/06	\$145,340
ASBMR Career Enhancement Award	Participation in a randomized controlled trial of the influence of dairy on bone mass accrual, bone size, and fat and lean body mass in early pubertal over- and healthy-weight girls	Principal investigator	01/01/09-12/31/09	\$54,549
AO Research	Repair of segmental bone defects using a novel, biodegradable, load-bearing carrier for demineralized bone matrix <i>Not funded (no score or critique provided)</i>	Principal investigator	01/01/05-12/31/05	\$35,805

PRINT AND ELECTRONIC PUBLICATIONS

(I) Service publications

Non-peer-reviewed service publications

1. **Warden SJ** (Ed.): Forward motion. *Department of Physical Therapy newsletter* 2006:1(1):1-8
2. **Warden SJ** (Ed.): Forward motion. *Department of Physical Therapy newsletter* 2007:2(1):1-8
3. **Warden SJ** (Ed.): Forward motion. *Department of Physical Therapy newsletter* 2007:2(2):1-8
4. **Warden SJ** (Ed.): Forward motion. *Department of Physical Therapy newsletter* 2008:3(1):1-8

(II) Teaching publications

Peer-reviewed teaching articles

5. Bayliss AJ and **Warden SJ**: The effect of computer assisted vs. traditional lecture-based instruction on physical therapy student performance in cardiopulmonary practice patterns (submitted)

Non-peer-reviewed teaching publications

6. Crossley KM, Cowan SM and **Warden SJ**: Evidenced-based assessment and management of patellofemoral pain. *Workshop handbook* June 11th 2006, pp. 1-75

(III) Research or creative activity publications

(Underline indicates student co-author; *indicates direct supervisor of student co-author; #indicates corresponding author)

Peer-reviewed research articles

7. **Warden SJ**[#], Turner CH: Mechanotransduction in cortical bone is most efficient at loading frequencies of 5-10 Hz. *Bone* 2004;34:261-70
8. Bennell K, Crossley K, Jayanara J, Walton E, **Warden S**, Kiss ZS, Wrigley T: Ground reaction forces and bone parameters in females with tibial stress fracture. *Medicine and Science in Sports and Exercise* 2004;36:397-404
9. **Warden SJ**[#], Morris HG, Crossley KM, Brukner PD, Bennell KL: Delayed- and non-union following opening wedge high tibial osteotomy: surgeons' results from 182 completed cases. *Knee Surgery, Sports Traumatology, Arthroscopy* 2005;13:34-7
10. **Warden SJ**[#], Robling AG, Sanders MS^{*}, Bliziotis MM, Turner CH: Inhibition of the serotonin (5-hydroxytryptamine) transporter attenuates bone mineral accrual during growth. *Endocrinology* 2005;146:685-93
11. Schriefer JL, Robling AG, **Warden SJ**, Fournier AJ, Mason JJ, Turner CH: A comparison of mechanical properties derived from multiple skeletal sites of mice. *Journal of Biomechanics* 2005;38:467-75
12. Alam I, **Warden SJ**, Robling AG, Turner CH: Mechanotransduction in bone does not require a functional cyclooxygenase-2 (COX-2) gene. *Journal of Bone and Mineral Research* 2005;20:438-46
13. **Warden SJ**[#], Hurst JA, *Sanders MS, Turner CH, Burr DB, Li J: Bone adaptation to a mechanical loading program significantly increases skeletal fatigue resistance. *Journal of Bone and Mineral Research* 2005;20:809-16
14. Schriefer JL, **Warden SJ**, Saxon LK, Robling AG, Turner CH: Cellular accommodation and the response of bone to mechanical loading. *Journal of Biomechanics* 2005;38:1838-45
15. **Warden SJ**[#], Saxon LK, Castillo AB, Turner CH: Knee ligament mechanical properties are not influenced by estrogen or its receptors. *American Journal of Physiology: Endocrinology and Metabolism* 2006;290:E1034-40
16. **Warden SJ**[#], Avin KG^{*}, Beck EM^{*}, DeWolf ME^{*}, Hagemeier MA^{*}, Martin KM^{*}: Knee ligament healing is accelerated by low-intensity pulsed ultrasound and delayed by a non-steroidal anti-inflammatory drug. *American Journal of Sports Medicine* 2006;34:1094-102
17. Chu TM, Sargent P, **Warden SJ**, Turner CH, Stewart RL: Preliminary evaluation of a load-bearing BMP-2 carrier for segmental defect regeneration. *Biomedical Sciences Instrumentation* 2006;42:42-7
18. **Warden SJ**[#], Fuchs RK, Kessler CK^{*}, Avin KG^{*}, Cardinal RE^{*} and Stewart RL: Ultrasound produced by a conventional therapeutic ultrasound unit accelerates fracture repair. *Physical Therapy* 2006;86:1118-1127

19. Sawakami K, Robling AG, Ai M, Pitner ND, Liu D, **Warden SJ**, Li J, Maye P, Rowe DW, Duncan RL, Warman ML, Turner CH: The WNT co-receptor LRP5 is essential for skeletal mechanotransduction, but not for the anabolic bone response to parathyroid hormone treatment. *Journal of Biological Chemistry* 2006;281:23698-711
20. Castillo AB, Alam I, Tanaka SM, Levenda J, Li J, **Warden SJ**, Turner CH: Effects of low amplitude, broad-frequency vibration on cortical bone formation in mice. *Bone* 2006;39:1087-96
21. Chu TM, **Warden SJ**, Turner CH, Stewart RL: Segmental defect regeneration using a load bearing biodegradable carrier of bone morphogenic protein-2. *Biomaterials* 2007;28:459-67
22. **Warden SJ**[#], Fuchs RK, Castillo AB, Nelson IR*, Turner CH: Exercise when young provides lifelong benefits to bone structure and strength. *Journal of Bone and Mineral Research* 2007;22:251-9
23. **Warden SJ**[#], Kiss ZS, Malara FA, Ooi ABT*, Cook JL, Crossley KM: Comparative accuracy of magnetic resonance imaging and ultrasonography in confirming patellar tendinopathy. *American Journal of Sports Medicine* 2007;35:427-36
24. Robling AG, **Warden SJ**, Schultz KL, Beamer WG, Turner CH: Genetic effects on bone mechanotransduction in congenic mice harboring bone size and strength quantitative trait loci *Journal of Bone and Mineral Research* 2007;22:984-91
25. Crossley KM, Thancanamootoo K*, Metcalf BR, Cook JL, Purdam CR, **Warden SJ**[#]: Clinical features of patellar tendinopathy and their implications for rehabilitation. *Journal of Orthopaedic Research* 2007;25:1164-75
26. Li J, Waugh LJ*, Hui SL, Burr DB, **Warden SJ**: Low-intensity pulsed ultrasound and a non-steroidal anti-inflammatory drug have opposing effects during stress fracture repair. *Journal of Orthopaedic Research* 2007;25:1559-67
27. **Warden SJ**[#], Hinman RS, Watson MA Jr*, Avin KG*, Bialocerkowski AE, Crossley KM: Patellar taping and bracing for the treatment of chronic knee pain: a systematic review and meta-analysis. *Arthritis and Rheumatism: Arthritis Care and Research* 2008;59:78-83
28. **Warden SJ**[#], Metcalf BR, Cook JL, Purdam CR, Bennell KL, Crossley KM: Low-intensity pulsed ultrasound for chronic patellar tendinopathy: a randomized, placebo-controlled, double-blind trial. *Rheumatology* 2008;47:467-71
29. **Warden SJ**[#], Nelson IR*, Fuchs RK, Bliziotes MM, Turner CH: Serotonin (5-hydroxytryptamine) transporter inhibition causes bone loss in adult mice independently of estrogen deficiency. *Menopause* 2008;15:1176-1183
30. **Warden SJ**[#], Komatsu DE*, Rydberg J*, Hassett SM*, Bond JL*: Recombinant human parathyroid hormone (PTH 1-34) and low-intensity pulsed ultrasound have additive, contrasting effects during fracture healing. *Bone* 2009;44:485-94
31. Loghmani MT*, **Warden SJ**: Instrument-assisted cross fiber massage accelerates knee ligament healing. *Journal of Orthopaedic and Sports Physical Therapy* 2009;39:506-514
32. **Warden SJ**[#], Bogenschutz ED*, Smith HD*, Gutierrez AR*: Throwing induces substantial torsional adaptation within the midshaft humeral of male baseball players. *Bone* (in press)
33. Golomb MR, McDonald B, **Warden SJ**, Yonkman J, Saykin A, Shirley B, Huber M, Rabin B, Abdelaky M, Nwosu M, Barkat-Masih M, Burdea G: In-home virtual reality videogame telerehabilitation in adolescents with hemiplegic cerebral palsy (submitted)
34. **Warden SJ**[#], Bond JL*, Hassett SM*, Rydberg J*, Grogg J*, Hilles E*, Bogenschutz ED*, Smith HD*, Fuchs RK, Bliziotes MM, Turner CH: Psychotropic drugs have contrasting skeletal effects that are independent of their effects on physical activity levels (submitted)
35. Komatsu DE*, Mary MN, Schroeder RJ, Robling AG, Turner CH, **Warden SJ**[#]: Modulation of Wnt signaling influences fracture healing (submitted)
36. Swinford R*, **Warden SJ**[#]: Precision of musculoskeletal measures of the lower leg using peripheral quantitative computed tomography (submitted)
37. Loghmani MT*, **Warden SJ**: Instrument-assisted cross fiber massage improves regional blood flow in healing knee ligaments at delayed time points following treatment (in preparation)
38. Bogenschutz ED*, Smith HD*, Bayliss AJ, Altenburger P, **Warden SJ**[#]: Publication of orthopaedic and sports physical therapy abstracts presented at the annual Combined Sections Meeting: do we publish what we preach? (in preparation)
39. Smith HD*, Bogenschutz ED*, Gutierrez AR*, **Warden SJ**[#]: Playing position influences humeral bone adaptation in female softball players (in preparation)

40. Creaby M, Crossley KM, Bragge P, Dixon SJ, **Warden SJ**: A systematic review of risk factors associated with tibial stress fracture development in athletes and military (in preparation)
41. Marrero IC, **Warden SJ**, Merrell GA: Repair of flexor tendons using a knotless barbed suture: a comparative biomechanical study (in preparation)
42. Leitch SP, Bialocerkowski AE, Crossley KM, **Warden SJ**: Physical interventions for the management of Achilles tendinopathy: a systematic review (in preparation)

Peer-reviewed review articles

43. **Warden SJ**[#]: Cyclooxygenase-2 inhibitors: beneficial or detrimental for athletes with acute musculoskeletal injuries? *Sports Medicine* 2005;35:271-83
44. **Warden SJ**[#]: Animal models for the study of tendinopathy. *British Journal of Sports Medicine* 2007;41:232-40
45. **Warden SJ**[#], Haney EM: Skeletal effects of serotonin (5-hydroxytryptamine) transporter inhibition: evidence from in vitro and animal-based studies. *Journal of Musculoskeletal and Neuronal Interactions* 2008;8:121-32
46. Haney EM, **Warden SJ**: Skeletal effects of serotonin (5-hydroxytryptamine) transporter inhibition: evidence from clinical studies. *Journal of Musculoskeletal and Neuronal Interactions* 2008;8:133-45
47. **Warden SJ**[#], Robling AG, Haney EM, Turner CH, Bliziotes MM: The emerging role of serotonin (5-hydroxytryptamine) in the skeleton and its mediation of the skeletal effects of low-density lipoprotein receptor-related protein 5 (LRP5). *Bone* (in press)
48. Haney EM, **Warden SJ**, Bliziotes MM: The effects of selective serotonin reuptake inhibitor (SSRI) use in older adults and implications for screening. *Bone* (in press)

Invited review articles

49. **Warden SJ**, Fuchs RK, Turner CH: Steps for targeting exercise toward the skeleton to increase bone strength. *Europa Medicophysica* 2004;40:223-32
50. **Warden SJ**[#], Bliziotes MM, Eshleman AJ, Wren KW, Turner CH: Neural regulation of bone and the skeletal effects of serotonin (5-hydroxytryptamine). *Molecular and Cellular Endocrinology* 2005;242:1-9
51. **Warden SJ**[#], Fuchs RK, Castillo AB, Turner CH: Does exercise during growth influence osteoporotic fracture risk later in life? *Journal of Musculoskeletal and Neuronal Interactions* 2005;5:344-346
52. **Warden SJ**[#], Burr DB, Brukner PD: Stress fractures: pathophysiology, epidemiology and risk factors. *Current Osteoporosis Reports* 2006;4:103-9
53. **Warden SJ**[#], Creaby MW, Bryant AL, Crossley KM: Stress fracture risk factors in women soccer players and their clinical implications. *British Journal of Sports Medicine* 2007;41(Suppl. 1):i38-43
54. Fuchs RK, **Warden SJ**: Combination therapy using exercise and pharmaceutical agents to optimize bone health. *Clinical Reviews in Bone and Mineral Metabolism* 2008;6:37-45
55. **Warden SJ**[#]: Development and use of animal models to advance tendinopathy research. *Frontiers in Biosciences* 2009;14:4588-97
56. Turner CH, **Warden SJ**, Bellido T, Plotkin LI, Kumar N, Jasiuk I, Danzig J, Robling AG: Mechanobiology of the skeleton. *Science Signaling* 2009;2:pt3
57. Komatsu DE, **Warden SJ**: The control of fracture repair. *Journal of Cellular Biochemistry* (in press)

Editorials

58. **Warden SJ**[#]: Breaking the rules for bone adaptation to mechanical loading. *Journal of Applied Physiology* 2006;100:1441-2
59. **Warden SJ**[#], Fuchs RK: Are 'exercise pills' the answer to the growing problem of physical inactivity? *British Journal of Sports Medicine* 2008;42:562-3
60. **Warden SJ**[#]: Prophylactic abuse and recommended use of non-steroidal anti-inflammatory drugs (NSAIDs) by athletes. *British Journal of Sports Medicine* (in press)
61. **Warden SJ**[#], Fuchs RK: Exercise and bone health: optimizing structure during growth is key, but all is not in vain during aging. *British Journal of Sports Medicine* (in press)

Case reports

62. **Warden SJ**: Extreme skeletal adaptation in a male baseball player (submitted)

Letters

63. **Warden SJ**: RE: Letter from Fiona Thompson. *Journal of the Australian Association of Massage Therapists* 2006;4:31-32
64. **Warden SJ**: On “Journal publication productivity...” Richter et al. *Phys Ther* 2008;88:376-386. *Physical Therapy* 2008;88:538-9

Book chapters

65. **Warden SJ**, Burr DB, Brukner PD: Repetitive stress pathology: bone. In: Magee DJ, Zachazewski JE, Quillen WS (eds.): *Pathology and Intervention in Musculoskeletal Rehabilitation*. St. Louis, MO: Saunders Elsevier; 2009, pp. 685-705
66. Fuchs RK, **Warden SJ**, Turner CH: Bone anatomy, physiology and adaptation to mechanical loading. In: Planell JA, Lacroix D, Merolli A, Best SM (eds.): *Bone Repair Biomaterials*. Woodhead Publishing Ltd.: Cambridge, UK; 2009, pp. 25-68
67. **Warden SJ**, Altenburger P: Ultrasound mediated healing. In: Frenkel V (ed.): *Therapeutic Ultrasound: Mechanisms to Applications*. Nova Science Publishers, Inc.: Hauppauge NY (in press)
68. **Warden SJ**, Fuchs RK: Exercise, physical stress, and bone. In: Anderson JJB, Garner SC, Klemmer PJ (eds.): *Nutrition and Bone Health*. CRC Press (in preparation)

Published abstracts

(Underline indicates student co-author; *indicates direct supervisor of student co-author)

69. **Warden SJ**, Turner CH: Cortical bone augmentation with mechanical loading is best at a loading frequency of 10 Hz. 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, USA. *Transactions of the Orthopaedic Research Society* 2004;29:196
70. **Warden SJ**, Robling AG, Bliziotes MM, Turner CH: Serotonin (5-HT) influences bone mass, size and strength, but is not involved in mechanotransduction. 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, USA. *Transactions of the Orthopaedic Research Society* 2004;29:352
71. Schriefer JL, **Warden SJ**, Saxon L, Robling AG, Turner CH: A large, initial increase in load is more important than small, progressive increases: Implications for the design of exercise programs for bone. 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, USA. *Transactions of the Orthopaedic Research Society* 2004;29:389
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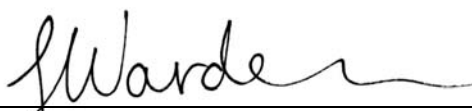
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07/28/2009

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(Signature of Candidate)