

# Stanford

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## Simon Chow

Life Science Rsch Prof 3, Orthopaedic Surgery

### Bio

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#### BIO

Simon Chow is the laboratory manager (LSRP3) at the Goodman Lab who have obtained his MSc in Biomedical Engineering in 2009 and his PhD in Orthopaedics and Traumatology in 2014. He subsequently served as a Research Assistant Professor at the Department of Orthopaedic and Traumatology at the Chinese University of Hong Kong (CUHK) from 2016 to 2022. Simon has had extensive experience 2005 in musculoskeletal aging related to muscle and bone regeneration; establishment of animal models for orthopaedic research; the role of inflammation in bone regeneration. His expertise extends from in vitro, in vivo pre-clinical studies to surgical and community-based clinical studies with proven published track record.

#### CURRENT ROLE AT STANFORD

Laboratory Manager, Goodman Lab.

#### EDUCATION AND CERTIFICATIONS

- Postdoctoral Research Fellow, The Chinese University of Hong Kong , Orthopaedics and Traumatology (2016)
- PhD, The Chinese University of Hong Kong , Orthopaedics and Traumatology (2014)
- MSc, The Chinese University of Hong Kong , Biomedical Engineering (2009)
- BSc, University of Toronto , Human Biology (2002)

#### LINKS

- ORCID: <https://orcid.org/0000-0003-1742-980X>
- Google Scholar: <https://scholar.google.com/citations?user=Am3jJMUAJ&hl=en>

### Professional

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#### WORK EXPERIENCE

- Research Assistant Professor - The Chinese University of Hong Kong (9/1/2016 - 8/31/2022)
- Postdoctoral Research Fellow - The Chinese University of Hong Kong. (9/1/2014 - 8/31/2016)
- Research Assistant - The Chinese University of Hong Kong (10/12/2005 - 8/31/2014)

#### PROFESSIONAL AFFILIATIONS AND ACTIVITIES

- Editorial Board Member, Journal of Orthopaedic Research (2021 - present)
- Editorial Board Member, BMC Musculoskeletal Disorder (2023 - present)
- Editorial Board Member, Scientific Reports (2022 - present)

## Publications

### PUBLICATIONS

- **Does Exercise Influence Skeletal Muscle by Modulating Mitochondrial Functions via Regulating MicroRNAs? A Systematic Review.** *Ageing research reviews*  
Long, Y. F., Chow, S. K., Cui, C., Wong, R. M., Zhang, N., Qin, L., Law, S. W., Cheung, W. H.  
2023; 102048
- **Glycolytic reprogramming in macrophages and MSCs during inflammation.** *Frontiers in immunology*  
Li, X., Shen, H., Zhang, M., Teissier, V., Huang, E. E., Gao, Q., Tsubosaka, M., Toya, M., Kushioka, J., Maduka, C. V., Contag, C. H., Chow, S. K., Zhang, et al  
2023; 14: 1199751
- **CCL2 promotes osteogenesis by facilitating macrophage migration during acute inflammation.** *Frontiers in cell and developmental biology*  
Toya, M., Zhang, N., Tsubosaka, M., Kushioka, J., Gao, Q., Li, X., Chow, S. K., Goodman, S. B.  
2023; 11: 1213641
- **Modulating macrophage polarization for the enhancement of fracture healing, a systematic review.** *Journal of orthopaedic translation*  
Chow, S. K., Wong, C. H., Cui, C., Li, M. M., Wong, R. M., Cheung, W. H.  
2022; 36: 83-90
- **HR-pQCT for the Evaluation of Muscle Quality and Intramuscular Fat Infiltration in Ageing Skeletal Muscle** *JOURNAL OF PERSONALIZED MEDICINE*  
Chow, S., van Mourik, M., Hung, V., Zhang, N., Li, M., Wong, R., Leung, K., Cheung, W.  
2022; 12 (6)
- **Diagnosis of sarcopenia by evaluating skeletal muscle mass by adjusted bioimpedance analysis validated with dual-energy X-ray absorptiometry.** *Journal of cachexia, sarcopenia and muscle*  
Cheng, K. Y., Chow, S. K., Hung, V. W., Wong, C. H., Wong, R. M., Tsang, C. S., Kwok, T., Cheung, W. H.  
2021; 12 (6): 2163-2173
- **Acute Inflammatory Response in Osteoporotic Fracture Healing Augmented with Mechanical Stimulation is Regulated In Vivo through the p38-MAPK Pathway.** *International journal of molecular sciences*  
Chow, S. K., Cui, C., Cheng, K. Y., Chim, Y. N., Wang, J., Wong, C. H., Ng, K. W., Wong, R. M., Cheung, W. H.  
2021; 22 (16)
- **Inflammatory response in postmenopausal osteoporotic fracture healing.** *Bone & joint research*  
Chow, S. K., Chim, Y. N., Wang, J. Y., Wong, R. M., Choy, V. M., Cheung, W. H.  
2020; 9 (7): 368-385
- **Vibration and #-hydroxy-#-methylbutyrate treatment suppresses intramuscular fat infiltration and adipogenic differentiation in sarcopenic mice.** *Journal of cachexia, sarcopenia and muscle*  
Wang, J., Cui, C., Chim, Y. N., Yao, H., Shi, L., Xu, J., Wang, J., Wong, R. M., Leung, K. S., Chow, S. K., Cheung, W. H.  
2020; 11 (2): 564-577
- **Bone regeneration in inflammation with aging and cell-based immunomodulatory therapy.** *Inflammation and regeneration*  
Kushioka, J., Chow, S. K., Toya, M., Tsubosaka, M., Shen, H., Gao, Q., Li, X., Zhang, N., Goodman, S. B.  
2023; 43 (1): 29
- **Sarcopenia and Ageing.** *Sub-cellular biochemistry*  
Cheng, K. Y., Bao, Z., Long, Y., Liu, C., Huang, T., Cui, C., Chow, S. K., Wong, R. M., Cheung, W. H.  
2023; 103: 95-120
- **Hydrogel Delivery of DNase I and Liposomal Vancomycin to Eradicate Fracture-related Methicillin-resistant Staphylococcus aureus Infection and Support Osteoporotic Fracture Healing.** *Acta biomaterialia*  
Li, J., Leung, S. Y., Chung, Y. L., Chow, S. K., Alt, V., Rupp, M., Brochhausen, C., Chui, C. S., Ip, M., Cheung, W. H., Wong, R. M.  
2023
- **The role of obesity in sarcopenia and the optimal body composition to prevent against sarcopenia and obesity.** *Frontiers in endocrinology*  
Liu, C., Cheng, K. Y., Tong, X., Cheung, W. H., Chow, S. K., Law, S. W., Wong, R. M.  
2023; 14: 1077255

- **Deciphering the "obesity paradox" in the elderly: A systematic review and meta-analysis of sarcopenic obesity.** *Obesity reviews : an official journal of the International Association for the Study of Obesity*  
Liu, C., Wong, P. Y., Chung, Y. L., Chow, S. K., Cheung, W. H., Law, S. W., Chan, J. C., Wong, R. M.  
2023; 24 (2): e13534
- **Does the regulation of skeletal muscle influence cognitive function? A scoping review of pre-clinical evidence.** *Journal of orthopaedic translation*  
Liu, C., Wong, P. Y., Chow, S. K., Cheung, W. H., Wong, R. M.  
2023; 38: 76-83
- **The imminent risk of a fracture-existing worldwide data: a systematic review and meta-analysis.** *Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA*  
Wong, R. M., Wong, P. Y., Liu, C., Wong, H. W., Chung, Y. L., Chow, S. K., Law, S. W., Cheung, W. H.  
2022; 33 (12): 2453-2466
- **Recommendations on the post-acute management of the osteoporotic fracture - Patients with "very-high" Re-fracture risk.** *Journal of orthopaedic translation*  
Wong, R. M., Cheung, W. H., Chow, S. K., Ng, R. W., Li, W., Hsu, A. Y., Wong, K. K., Ho, A. W., Choi, S. H., Fang, C. X., Chan, C. F., Leung, K. H., Chu, et al  
2022; 37: 94-99
- **Coapplication of Magnesium Supplementation and Vibration Modulate Macrophage Polarization to Attenuate Sarcopenic Muscle Atrophy through PI3K/Akt/mTOR Signaling Pathway.** *International journal of molecular sciences*  
Cui, C., Bao, Z., Chow, S. K., Wong, R. M., Welch, A., Qin, L., Cheung, W. H.  
2022; 23 (21)
- **Current therapeutic interventions combating biofilm-related infections in orthopaedics : a systematic review of in vivo animal studies.** *Bone & joint research*  
Li, J., Cheung, W. H., Chow, S. K., Ip, M., Leung, S. Y., Wong, R. M.  
2022; 11 (10): 700-714
- **Regulation of mitochondrial dynamic equilibrium by physical exercise in sarcopenia: A systematic review.** *Journal of orthopaedic translation*  
Long, Y. F., Chow, S. K., Cui, C., Wong, R. M., Qin, L., Law, S. W., Cheung, W. H.  
2022; 35: 37-52
- **Osteocyte-specific dentin matrix protein 1 : the role of mineralization regulation in low-magnitude high-frequency vibration enhanced osteoporotic fracture healing.** *Bone & joint research*  
Li, M. C., Chow, S. K., Wong, R. M., Chen, B., Cheng, J. C., Qin, L., Cheung, W. H.  
2022; 11 (7): 465-476
- **Effects of Whole-Body Vibration Therapy on Knee Osteoarthritis: A Systematic Review and Meta-Analysis of Randomized Controlled Trials.** *Journal of rehabilitation medicine*  
Qiu, C. G., Chui, C. S., Chow, S. K., Cheung, W. H., Wong, R. M.  
2022; 54: jrm00266
- **High Charlson Comorbidity Index Score is associated with early fracture-related complication for internal fixation of neck of femur fractures.** *Scientific reports*  
Wong, R. M., Zu, Y., Chau, W. W., Tso, C. Y., Liu, W. H., Ng, R. W., Chow, S. K., Cheung, W. H., Tang, N., Ho, K. K.  
2022; 12 (1): 4749
- **Low-Intensity Pulsed Ultrasound Stimulation for Bone Fractures Healing: A Review.** *Journal of ultrasound in medicine : official journal of the American Institute of Ultrasound in Medicine*  
Palanisamy, P., Alam, M., Li, S., Chow, S. K., Zheng, Y. P.  
2022; 41 (3): 547-563
- **Fracture-related infection in osteoporotic bone causes more severe infection and further delays healing.** *Bone & joint research*  
Li, J., Wong, R. M., Chung, Y. L., Leung, S. S., Chow, S. K., Ip, M., Cheung, W. H.  
2022; 11 (2): 49-60
- **Muscle plays a more superior role than fat in bone homeostasis: A cross-sectional study of old Asian people.** *Frontiers in endocrinology*  
Liu, C., Wong, P. Y., Tong, X., Chow, S. K., Hung, V. W., Cheung, W. H., Qin, L., Law, S. W., Wong, R. M.  
2022; 13: 990442

- **Vibration therapy as an intervention for enhancing trochanteric hip fracture healing in elderly patients: a randomized double-blinded, placebo-controlled clinical trial.** *Trials*  
Wong, R. M., Chow, S. K., Tang, N., Chung, Y. L., Griffith, J., Liu, W. H., Ng, R. W., Tso, C. Y., Cheung, W. H.  
2021; 22 (1): 878
- **3D printing in orthopaedic surgery: a scoping review of randomized controlled trials.** *Bone & joint research*  
Wong, R. M., Wong, P. Y., Liu, C., Chung, Y. L., Wong, K. C., Tso, C. Y., Chow, S. K., Cheung, W. H., Yung, P. S., Chui, C. S., Law, S. W.  
2021; 10 (12): 807-819
- **Understanding the gut microbiota and sarcopenia: a systematic review.** *Journal of cachexia, sarcopenia and muscle*  
Liu, C., Cheung, W. H., Li, J., Chow, S. K., Yu, J., Wong, S. H., Ip, M., Sung, J. J., Wong, R. M.  
2021; 12 (6): 1393-1407
- **Best Performance Parameters of HR-pQCT to Predict Fragility Fracture: Systematic Review and Meta-Analysis.** *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research*  
Cheung, W. H., Hung, V. W., Cheuk, K. Y., Chau, W. W., Tsoi, K. K., Wong, R. M., Chow, S. K., Lam, T. P., Yung, P. S., Law, S. W., Qin, L.  
2021; 36 (12): 2381-2398
- **The first reported fracture liaison service (FLS) for vertebral fractures in China: is muscle the missing gap?** *Archives of osteoporosis*  
Wong, R. M., Ko, S. Y., Chau, W. W., Lee, L. C., Chow, S. K., Cheung, W. H., Law, S. W.  
2021; 16 (1): 168
- **Dangers with cementation under low-viscosity state: Cement arterio-venogram and bone cement implantation syndrome.** *Trauma case reports*  
Wan, R. C., Liu, W. H., Ng, R. W., Tso, C. Y., Chow, S. K., Cheung, W. H., Tang, N., Wong, R. M.  
2021; 35: 100517
- **Prognostic factors related to ambulation deterioration after 1-year of geriatric hip fracture in a Chinese population.** *Scientific reports*  
Wong, R. M., Qin, J., Chau, W. W., Tang, N., Tso, C. Y., Wong, H. W., Chow, S. K., Leung, K. S., Cheung, W. H.  
2021; 11 (1): 14650
- **The role of osteocytes-specific molecular mechanism in regulation of mechanotransduction - A systematic review.** *Journal of orthopaedic translation*  
Li, M. C., Chow, S. K., Wong, R. M., Qin, L., Cheung, W. H.  
2021; 29: 1-9
- **Enhancement of osteoporotic fracture healing by vibration treatment: The role of osteocytes.** *Injury*  
Cheung, W. H., Wong, R. M., Choy, V. M., Li, M. C., Cheng, K. Y., Chow, S. K.  
2021; 52 Suppl 2: S97-S100
- **The role of gut microbiota in bone homeostasis.** *Bone & joint research*  
Li, J., Ho, W. T., Liu, C., Chow, S. K., Ip, M., Yu, J., Wong, H. S., Cheung, W. H., Sung, J. J., Wong, R. M.  
2021; 10 (1): 51-59
- **Fibrinolysis as a target to enhance osteoporotic fracture healing by vibration therapy in a metaphyseal fracture model.** *Bone & joint research*  
Wong, R. M., Choy, V. M., Li, J., Li, T. K., Chim, Y. N., Li, M. C., Cheng, J. C., Leung, K. S., Chow, S. K., Cheung, W. H.  
2021; 10 (1): 41-50
- **Efficacy of low-magnitude high-frequency vibration (LMHFV) on musculoskeletal health of participants on wheelchair: a study protocol for a single-blinded randomised controlled study.** *BMJ open*  
Chow, S. K., Ho, C. Y., Wong, H. W., Chim, Y. N., Wong, R. M., Cheung, W. H.  
2020; 10 (12): e038578
- **AChRs Degeneration at NMJ in Aging-Associated Sarcopenia-A Systematic Review.** *Frontiers in aging neuroscience*  
Bao, Z., Cui, C., Chow, S. K., Qin, L., Wong, R. M., Cheung, W. H.  
2020; 12: 597811
- **Impact of COVID-19 on orthopaedic clinical service, education and research in a university hospital.** *Journal of orthopaedic translation*  
Ong, M. T., Ling, S. K., Wong, R. M., Ho, K. K., Chow, S. K., Cheung, L. W., Yung, P. S.  
2020; 25: 125-127
- **A systematic review on current osteosynthesis-associated infection animal fracture models.** *Journal of orthopaedic translation*

- Wong, R. M., Li, T. K., Li, J., Ho, W. T., Chow, S. K., Leung, S. S., Cheung, W. H., Ip, M.  
2020; 23: 8-20
- **Elastic-band resistance exercise or vibration treatment in combination with hydroxymethylbutyrate (HMB) supplement for management of sarcopenia in older people: a study protocol for a single-blinded randomised controlled trial in Hong Kong.** *BMJ open*  
Chow, S. K., Chim, Y. N., Cheng, K. Y., Ho, C. Y., Ho, W. T., Cheng, K. C., Wong, R. M., Cheung, W. H.  
2020; 10 (6): e034921
  - **How much do we know about the role of osteocytes in different phases of fracture healing? A systematic review.** *Journal of orthopaedic translation*  
Choy, M. H., Wong, R. M., Chow, S. K., Li, M. C., Chim, Y. N., Li, T. K., Ho, W. T., Cheng, J. C., Cheung, W. H.  
2020; 21: 111-121
  - **Can we enhance osteoporotic metaphyseal fracture healing through enhancing ultrastructural and functional changes of osteocytes in cortical bone with low-magnitude high-frequency vibration?** *FASEB journal : official publication of the Federation of American Societies for Experimental Biology*  
Choy, M. V., Wong, R. M., Li, M. C., Wang, B. Y., Liu, X. D., Lee, W., Cheng, J. C., Chow, S. K., Cheung, W. H.  
2020; 34 (3): 4234-4252
  - **A study protocol for a randomized controlled trial evaluating vibration therapy as an intervention for postural training and fall prevention after distal radius fracture in elderly patients.** *Trials*  
Wong, R. M., Ho, W. T., Tang, N., Tso, C. Y., Ng, W. K., Chow, S. K., Cheung, W. H.  
2020; 21 (1): 95
  - **Impaired fracture healing in sarco-osteoporotic mice can be rescued by vibration treatment through myostatin suppression.** *Journal of orthopaedic research : official publication of the Orthopaedic Research Society*  
Zhang, N., Chim, Y. N., Wang, J., Wong, R. M., Chow, S. K., Cheung, W. H.  
2019
  - **Muscle-generated BDNF is a sexually dimorphic myokine that controls metabolic flexibility** *SCIENCE SIGNALING*  
Yang, X., Brobst, D., Chan, W., Tse, M., Herlea-Pana, O., Ahuja, P., Bi, X., Zaw, A., Kwong, Z., Jia, W., Zhang, Z., Zhang, N., Chow, et al  
2019; 12 (594)
  - **One-year mortality in displaced intracapsular hip fractures and associated risk: a report of Chinese-based fragility fracture registry.** *Journal of orthopaedic surgery and research*  
Chow, S. K., Qin, J. H., Wong, R. M., Yuen, W. F., Ngai, W. K., Tang, N., Lam, C. Y., Lau, T. W., Lee, K. B., Siu, K. M., Wong, S. H., Zhu, T. Y., Cheung, et al  
2018; 13 (1): 235
  - **Validation Study of the Thumb Ossification Composite Index (TOCI) in Idiopathic Scoliosis: A Stage-to-Stage Correlation with Classic Tanner-Whitehouse and Sanders Simplified Skeletal Maturity Systems.** *The Journal of bone and joint surgery. American volume*  
Hung, A. L., Shi, B., Chow, S. K., Chau, W. W., Hung, V. W., Wong, R. M., Liu, K. L., Lam, T. P., Ng, B. K., Cheng, J. C.  
2018; 100 (13): 88
  - **An animal model of co-existing sarcopenia and osteoporotic fracture in senescence accelerated mouse prone 8 (SAMP8)** *EXPERIMENTAL GERONTOLOGY*  
Zhang, N., Chow, S., Leung, K., Lee, H., Cheung, W.  
2017; 97: 1-8
  - **Low-Magnitude High-Frequency Vibration Accelerated the Foot Wound Healing of n5-streptozotocin-induced Diabetic Rats by Enhancing Glucose Transporter 4 and Blood Microcirculation.** *Scientific reports*  
Yu, C. O., Leung, K. S., Jiang, J. L., Wang, T. B., Chow, S. K., Cheung, W. H.  
2017; 7 (1): 11631
  - **Thumb Ossification Composite Index (TOCI) for Predicting Peripubertal Skeletal Maturity and Peak Height Velocity in Idiopathic Scoliosis: A Validation Study of Premenarchal Girls with Adolescent Idiopathic Scoliosis Followed Longitudinally Until Skeletal Maturity.** *The Journal of bone and joint surgery. American volume*  
Hung, A. L., Chau, W. W., Shi, B., Chow, S. K., Yu, F. Y., Lam, T. P., Ng, B. K., Qiu, Y., Cheng, J. C.  
2017; 99 (17): 1438-1446
  - **The characterization of a full-thickness excision open foot wound model in n5-streptozotocin (STZ)-induced type 2 diabetic rats that mimics diabetic foot ulcer in terms of reduced blood circulation, higher C-reactive protein, elevated inflammation, and reduced cell proliferation.** *Experimental animals*  
Yu, C. O., Leung, K. S., Fung, K. P., Lam, F. F., Ng, E. S., Lau, K. M., Chow, S. K., Cheung, W. H.  
2017; 66 (3): 259-269

- **Inflammation and age-associated skeletal muscle deterioration (sarcopaenia).** *Journal of orthopaedic translation*  
Wang, J., Leung, K. S., Chow, S. K., Cheung, W. H.  
2017; 10: 94-101
- **Ultrasound as a stimulus for musculoskeletal disorders** *JOURNAL OF ORTHOPAEDIC TRANSLATION*  
Zhang, N., Chow, S., Leung, K., Cheung, W.  
2017; 9: 52-59
- **Effect of Low-Magnitude, High-Frequency Vibration Treatment on Retardation of Sarcopenia: Senescence-Accelerated Mouse-P8 Model.** *Rejuvenation research*  
Guo, A. Y., Leung, K. S., Qin, J. H., Chow, S. K., Cheung, W. H.  
2016; 19 (4): 293-302
- **Bone formation and degradation behavior of nanocrystalline hydroxyapatite with or without collagen-type 1 in osteoporotic bone defects - an experimental study in osteoporotic goats.** *Injury*  
Alt, V., Cheung, W. H., Chow, S. K., Thormann, U., Cheung, E. N., Lips, K. S., Schnettler, R., Leung, K. S.  
2016; 47 Suppl 2: S58-65
- **Fracture healing in osteoporotic bone.** *Injury*  
Cheung, W. H., Miclau, T., Chow, S. K., Yang, F. F., Alt, V.  
2016; 47 Suppl 2: S21-6
- **Ultrasound and fragility fracture: is there a role?** *Injury*  
Cheung, W. H., Leung, K. S., Chow, S. K.  
2016; 47 Suppl 1: S39-42
- **Muscle mass, structural and functional investigations of senescence-accelerated mouse P8 (SAMP8).** *Experimental animals*  
Guo, A. Y., Leung, K. S., Siu, P. M., Qin, J. H., Chow, S. K., Qin, L., Li, C. Y., Cheung, W. H.  
2015; 64 (4): 425-33
- **Coadministrating luteolin minimizes the side effects of the aromatase inhibitor letrozole.** *The Journal of pharmacology and experimental therapeutics*  
Li, F., Wong, T. Y., Lin, S. M., Chow, S., Cheung, W. H., Chan, F. L., Chen, S., Leung, L. K.  
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- **Callus formation is related to the expression ratios of estrogen receptors-alpha and -beta in ovariectomy-induced osteoporotic fracture healing.** *Archives of orthopaedic and trauma surgery*  
Chow, S. K., Leung, K. S., Qin, L., Wei, F., Cheung, W. H.  
2014; 134 (10): 1405-16
- **Low intensity pulsed ultrasound enhanced mesenchymal stem cell recruitment through stromal derived factor-1 signaling in fracture healing.** *PLoS one*  
Wei, F. Y., Leung, K. S., Li, G., Qin, J., Chow, S. K., Huang, S., Sun, M. H., Qin, L., Cheung, W. H.  
2014; 9 (9): e106722
- **The citrus flavonone hesperetin prevents letrozole-induced bone loss in a mouse model of breast cancer.** *journal of nutritional biochemistry*  
Li, F., Chow, S., Cheung, W., Chan, F. L., Chen, S., Leung, L. K.  
2013; 24 (6): 1112-1116
- **Three-dimensional high frequency power Doppler ultrasonography for the assessment of microvasculature during fracture healing in a rat model.** *Journal of orthopaedic research : official publication of the Orthopaedic Research Society*  
Sun, M. H., Leung, K. S., Zheng, Y. P., Huang, Y. P., Wang, L. K., Qin, L., Leung, A. H., Chow, S. K., Cheung, W. H.  
2012; 30 (1): 137-43
- **Restoration of longitudinal growth by bioengineered cartilage pellet in physeal injury is not affected by low intensity pulsed ultrasound.** *Journal of biomedical materials research. Part B, Applied biomaterials*  
Chow, S. K., Lee, K. M., Qin, L., Leung, K. S., Cheung, W. H.  
2011; 99 (1): 36-44
- **Low-intensity pulsed ultrasound accelerated callus formation, angiogenesis and callus remodeling in osteoporotic fracture healing.** *Ultrasound in medicine & biology*  
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