

# Cortical Bone Mechanical Properties Are Altered in an Animal Model of Progressive Chronic Kidney Disease

[Login \(/login\)](#)

- [IUPUI ScholarWorks Repository](#)
- →
- [Open Access Faculty Articles](#)
- →
- [Open Access Publishing Fund](#)
- →
- [View Item](#)

# Cortical Bone Mechanical Properties Are Altered in an Animal Model of Progressive Chronic Kidney Disease

[Newman, Christopher L.](#); [Moe, Sharon M.](#); [Chen, Neal X.](#); [Hammond, Max A.](#); [Wallace, Joseph M.](#); [Nyman, Jeffrey S.](#); [Allen, Matthew R.](#)



Name: newman-2014-corti ...

Size: 431.2Kb

Format: PDF

[View/Open](#)

Permanent Link: <http://hdl.handle.net/1805/4568>

Date: 2014-06

Keywords: [chronic kidney disease](#); [whole bone mechanical properties](#)

Cite As: Newman, C. L., Moe, S. M., Chen, N. X., Hammond, M. A., Wallace, J. M., Nyman, J. S., & Allen, M. R. (2014). Cortical Bone Mechanical Properties Are Altered in an Animal Model of Progressive Chronic Kidney Disease. *PLoS one*, 9(6), e99262.

## Abstract:

Chronic kidney disease (CKD), which leads to cortical bone loss and increased porosity, increases the risk of fracture. Animal models have confirmed that these changes compromise whole bone mechanical properties. Estimates from whole bone testing suggest that material properties are negatively affected, though tissue-level assessments have not been conducted. Therefore, the goal of the present study was to examine changes in cortical bone at different length scales using a rat model with the progressive development of CKD. At 30 weeks of age (~75% reduction in kidney function), skeletally mature male Cy/+ rats were compared to their normal littermates. Cortical bone material properties were assessed with reference point indentation (RPI), atomic force microscopy (AFM), Raman spectroscopy, and high performance liquid chromatography (HPLC). Bones from animals with CKD had higher (+18%) indentation distance increase and first cycle energy dissipation (+8%) as measured by RPI. AFM indentation revealed a broader distribution of elastic modulus values in CKD animals with a greater proportion of both higher and lower modulus values compared to normal controls. Yet, tissue composition, collagen morphology, and collagen cross-linking fail to account for these differences. Though the specific skeletal tissue

alterations responsible for these mechanical differences remain unclear, these results indicate that cortical bone material properties are altered in these animals and may contribute to the increased fracture risk associated with CKD.

## This item appears in the following Collection(s)

- [Department of Anatomy and Cell Biology Works \(/handle/1805/4108\)](/handle/1805/4108)
- [Department of Biomedical Engineering Works \(/handle/1805/4002\)](/handle/1805/4002)
- [Open Access Publishing Fund \(/handle/1805/6519\)](/handle/1805/6519)



(<http://creativecommons.org/licenses/by/3.0/us/>) Except where otherwise noted, this item's license is described as Attribution 3.0 United States



[Show Statistical Information \(#\)](#)

## My Account

- [Login](#)
- [Register](#)

## Statistics

- [Most Popular Items](#)
- [Statistics by Country](#)
- [Most Popular Authors](#)

[About Us \(/page/about\)](/page/about) | [Contact Us \(/contact\)](/contact) | [Send Feedback \(/feedback\)](/feedback)

[\(/htmlmap\)](#)

## FULFILLING *the* PROMISE

[Privacy Notice \(http://ulib.iupui.edu/privacy\\_notice\)](http://ulib.iupui.edu/privacy_notice)



Copyright (<http://www.iu.edu/copyright/index.shtml>) ©2015

The Trustees of Indiana University (<http://www.iu.edu/>),

Copyright Complaints (<http://www.iu.edu/copyright/complaints.shtml>)